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SAR COMPLIANCE EVALUATION REPORT

Applicant Name: Sony Corporation 1-7-1 Konan Minato-ku Tokyo Japan, 108-0075	**Date of Testing:** 03/22/11 - 04/08/11 **Test Site/Location:** PCTEST Lab, Columbia, MD, USA **Test Report Serial No.:** 0Y1103150536 – R1.AK8

FCC ID: **AK8PCG41312L**

APPLICANT: **SONY CORPORATION**

EUT Type:	Laptop PC with WWAN, WLAN, LTE and Bluetooth
Application Type:	Certification
FCC Rule Part(s):	CFR §2.1093; FCC/OET Bulletin 65 Supplement C [June 2001]
Model(s):	PCG-41312L
Tx Frequency:	824.20 - 848.80 MHz (GSM 850) / 1850.20 - 1909.80 MHz (GSM 1900) 826.40 - 846.60 MHz (UMTS V) / 1852.4 - 1907.6 MHz (UMTS II) 824.70 - 848.31 MHz (Cellular CDMA) / 1851.25 - 1908.75 MHz (PCS CDMA) 779.5 - 784.5 MHz (LTE) / 2412 - 2462 MHz (WLAN 802.11b/g/n) 5180 - 5240 MHz (WLAN 802.11a/n) / 5260 - 5320 MHz (WLAN 802.11a/n) 5500 - 5700 MHz (WLAN 802.11 a/n) / 5745 - 5825 MHz (WLAN 802.11a/n)
Conducted Power:	32.31 dBm GSM 850 / 30.24 dBm GSM 1900 22.85 dBm UMTS V / 22.75 dBm UMTS II 25.15 dBm Cell. CDMA / 24.77 dBm PCS CDMA 24.00 dBm LTE / 15.78 dBm 2.4 GHz WLAN 16.02 dBm 5.2 GHz WLAN 802.11a / 16.06 dBm 5.3 GHz WLAN 802.11a 16.86 dBm 5.5 GHz WLAN 802.11a / 15.01 dBm 5.8 GHz WLAN 802.11a
Max. SAR Measurement:	0.12 W/kg GSM 850 Body SAR / 0.08 W/kg GSM 1900 Body SAR 0.06 W/kg UMTS V Body SAR / 0.08 W/kg UMTS II Body SAR 0.24 W/kg Cell. CDMA Body SAR / 0.14 W/kg PCS CDMA Body SAR 0.06 W/kg LTE Body SAR / 0.03 W/kg 2.4 GHz WLAN Body SAR 0.03 W/kg 5.2 GHz WLAN 802.11a / 0.03 W/kg 5.3 GHz WLAN 802.11a 0.06 W/kg 5.5 GHz WLAN 802.11a / 0.09 W/kg 5.8 GHz WLAN 802.11a
Test Device Serial No.:	Pre-Production [S/N: DVT 1559 1800003, DVT15590 1800006, DVT15590 1800004]

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE C95.1-1992 and has been tested in accordance with the measurement procedures specified in FCC/OET Bulletin 65 Supplement C (2001), IEEE 1528-2003 and in applicable Industry Canada Radio Standards Specifications (RSS); for North American frequency bands only.

Note: This revised Test Report (S/N: 0Y1103150536 – R1.AK8) supersedes and replaces the previously issued test report on the same subject EUT for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. Test results reported herein relate only to the item(s) tested.

PCTEST certifies that no party to this application has been subject to a denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 862.

Randy Ortanez
President

ACCREDITED
TESTING LABORATORY
CERTIFICATE #2041.01

1 LTE SPECIFICATIONS PER KDB 941225

KDB 941225 Pub LTE Information				
	FCC ID	**AK8PCG41312L**		
	Form Factor	Laptop		
1)	Frequency Range of each LTE transmission band	Band 13: 779.5 - 784.5 MHz		
2)	Channel Bandwidths	5 MHz, 10 MHz BW		
3)	H, M, L channel numbers and frequencies			
	Band 13	Low	Mid	High
	10MHz BW:	NA	782 MHz (CH:23230)	NA
	5 MHz BW:	779.5 MHz (CH:23206)	N/A	784.5 MHz (CH:23254)
4)(a)	UE Category	3		
(b)	Modulations Supported in UL	QPSK, 16QAM		
	LTE Transmitter and Antenna Implementation	Operational Description		
5)	Description of LTE Tx and Ant. Implementation	1 TX/RX Ant		
6)	LTE Voice available?	No Voice		
	Hotspot with LTE+WIFI	Yes		
7)	LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided)	Yes		
	A-MPR (Additional MPR) disabled for SAR Testing?	Yes		
8)	Conducted power Table provided for 1RB (low and high offset), 50% RB (centered), 100% RB	Yes		
9-10)	Non-LTE US Wireless Operating Modes/Band	RF Output Power	RF Exposure Configurations	
	835 MHz GPRS/EDGE	32.31 dBm	Body	
	1900 MHz GPRS/EDGE	30.24 dBm	Body	
	835 MHz WCDMA	22.85 dBm	Body	
	1900 MHz WCDMA	22.75 dBm	Body	
	835 MHz CDMA	25.13 dBm	Body	
	1900 MHz CDMA	23.77 dBm	Body	
	2.4 GHz Bluetooth	5.8 dBm	Body	
	2.4 GHz WI-FI	15.78 dBm	Body	
	5 GHz WI-FI	16.86 dBm	Body	
11)	Simultaneous Tx conditions	See Section 13 & Section 15 of the SAR Report		
12)	Power Reduction used for SAR Compliance?	No		
13-15)	Descriptions, SAR Test Plan Proposal, SAR Test Data for Power Reduction	N/A - Power Reduction Not Used		

T A B L E   O F   C O N T E N T S

2 INTRODUCTION

The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency (RF) radiation in ET Docket 93-62 on Aug. 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices. [1]

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [3] and Health Canada RF Exposure Guidelines Safety Code 6 [24]. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [4] is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-Ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

2.1 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Fig. 1-1).

$$SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{\rho dv}\right)$$

Figure 2-1
SAR Mathematical Equation

SAR is expressed in units of Watts per Kilogram (W/kg).

$$SAR = \frac{\sigma \cdot E^2}{\rho}$$

where:

σ = conductivity of the tissue-simulating material (S/m)
ρ = mass density of the tissue-simulating material (kg/m^3)
E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relation to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[6]

3 TEST SITE LOCATION

3.1 INTRODUCTION

The map at the right shows the location of the PCTEST LABORATORY in Columbia, Maryland. It is in proximity to the FCC Laboratory, the Baltimore-Washington International (BWI) airport, the city of Baltimore and Washington, DC.

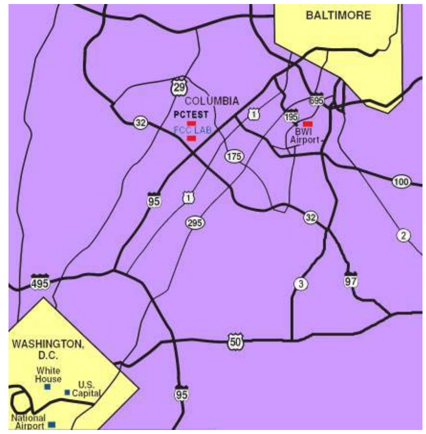

Figure 3-1
Map of the Greater Baltimore and Metropolitan Washington, D.C. area

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility in New Concept Business Park, Guilford Industrial Park, Columbia, Maryland. The site address is 6660-B Dobbin Road, Columbia, MD 21045. The test site is one of the highest points in the Columbia area with an elevation of 390 feet above mean sea level. The site coordinates are 39° 11'15" N latitude and 76° 49' 38" W longitude. The facility is 1.5 miles north of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. There are no FM or TV transmitters within 15 miles of the site. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4 on January 27, 2006 and Industry Canada.

3.2 Test Facility / Accreditations:

Measurements were performed at an independent accredited PCTEST Engineering Lab located in Columbia, MD 21045, U.S.A.

- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing-Aid Compatibility (HAC), Battery Safety, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST facility is an FCC registered (PCTEST Reg. No. 90864) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (IC-2451).
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and all Industry Canada Standards (RSS).

- PCTEST facility is an IC registered (IC-2451) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS and CDMA, and EvDO mobile phones.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO Data, CDMA 1xRTT Data

4 SAR MEASUREMENT SETUP

4.1 Robotic System

Measurements are performed using the DASY4 automated dosimetric assessment system. The DASY4 is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of a high precision robotics system (Staubli), robot controller, desktop computer, near-field probe, probe alignment sensor, and the SAM phantom containing the head or body equivalent material. The robot is a six-axis industrial robot, performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Figure 4-1).

4.2 System Hardware

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and a remote control used to drive the robot motors. The PC consists of the SAR Measurement Software DASY4, A/D interface card, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit that performs the signal amplification, signal multiplexing, A/D conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal from the DAE and transfers data to the PC card.

4.3 System Electronics

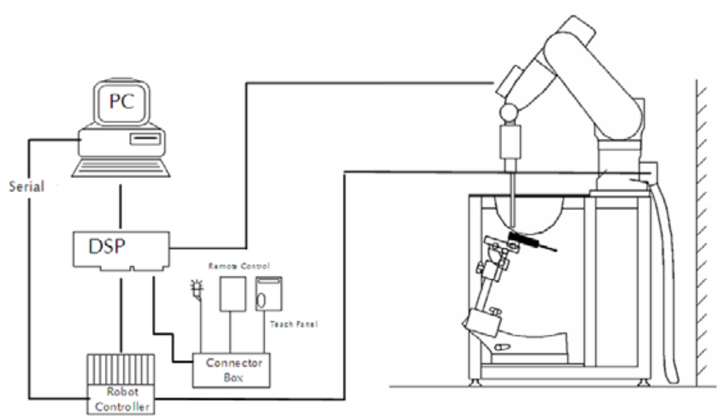

Figure 4-1
SAR Measurement System Setup

The DAE consists of a highly sensitive electrometer-grade auto-zeroing preamplifier, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

4.4 Automated Test System Specifications

Test Software:	SPEAG DASY4 version 4.7 Measurement Software
Robot:	Stäubli Unimation Corp. Robot RX60L
Repeatability:	0.02 mm
No. of Axes:	6

Data Acquisition Electronic System (DAE)

Data Converter

Features:	Signal Amplifier, multiplexer, A/D converter & control logic
Software:	SEMCAD software
Connecting Lines:	Optical Downlink for data and status info Optical upload for commands and clock

PC Interface Card

Function:	Link to DAE 16-bit A/D converter for surface detection system Two Serial & Ethernet link to robotics Direct emergency stop output for robot

Phantom

Type:	SAM Twin Phantom (V4.0)
Shell Material:	Composite
Thickness:	2.0 ± 0.2 mm

Figure 4-2
SAR Measurement System

5 DASY E-FIELD PROBE SYSTEM

5.1 Probe Measurement System

Figure 5-1
SAR System

The SAR measurements were conducted with the dosimetric probe designed in the classical triangular configuration (see Figure 5-3) and optimized for dosimetric evaluation [9]. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 software reads the reflection during a software approach and looks for the maximum using a 2nd order curve fitting (see Figure 6-1). The approach is stopped at reaching the maximum.

5.2 Probe Specifications

Model(s):	ES3DV2, ES3DV3, EX3DV4
Frequency Range:	10 MHz – 6.0 GHz (EX3DV4) 10 MHz – 4 GHz (ES3DV3)
Calibration:	In head and body simulating tissue at Frequencies from 300 up to 6000MHz
Linearity:	± 0.2 dB (30 MHz to 6 GHz) for EX3DV4 ± 0.2 dB (30 MHz to 4 GHz) for ES3DV3
Dynamic Range:	10 mW/kg – 100 W/kg
Probe Length:	330 mm
Probe Tip Length:	20 mm
Body Diameter:	12 mm
Tip Diameter:	2.5 mm (3.9mm for ES3DV3)
Tip-Center:	1 mm (2.0 mm for ES3DV3)
Application:	SAR Dosimetry Testing Compliance tests of mobile phones Dosimetry in strong gradient fields

Figure 5-2
Near-Field Probe

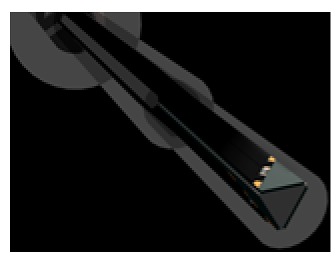

Figure 5-3
Triangular Probe Configuration

6 PROBE CALIBRATION PROCESS

6.1 Dosimetric Assessment Procedure

Each E-Probe/Probe Amplifier combination has unique calibration parameters. A TEM cell calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm^2) using an RF Signal generator, TEM cell, and RF Power Meter.

6.2 Free Space Assessment

The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and in a waveguide or other methodologies above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mW/cm^2.

6.3 Temperature Assessment

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated head tissue. The E-field in the medium correlates with the temperature rise in the dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$\text{SAR} = C\frac{\Delta T}{\Delta t}$$

where:

Δt = exposure time (30 seconds),

C = heat capacity of tissue (brain or muscle),

ΔT = temperature increase due to RF exposure.

$$\text{SAR} = \frac{|E|^2 \cdot \sigma}{\rho}$$

where:

σ = simulated tissue conductivity,

ρ = Tissue density (1.25 g/cm^3 for brain tissue)

SAR is proportional to $\Delta T/\Delta t$, the initial rate of tissue heating, before thermal diffusion takes place. The electric field in the simulated tissue can be used to estimate SAR by equating the thermally derived SAR to that with the E- field component.

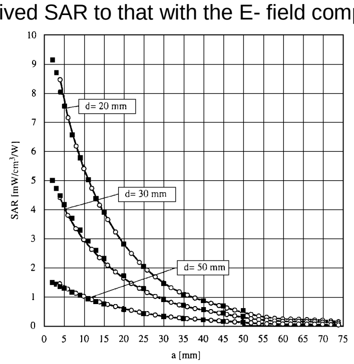

Figure 6-1 E-Field and Temperature measurements at 900MHz [9]

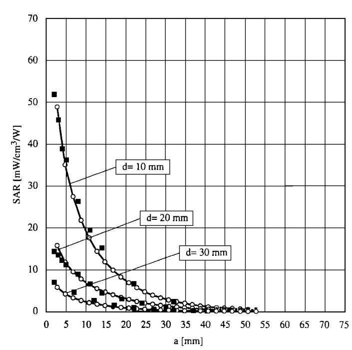

Figure 6-2 E-Field and temperature measurements at 1.9GHz [9]

7 PHANTOM AND EQUIVALENT TISSUES

7.1 SAM Phantoms

Figure 7-1
SAM Phantoms

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a table. The shape of the shell is based on data from an anatomical study designed to represent the 90^{th} percentile of the population [12][13]. The phantom enables the dosimetric evaluation of SAR for both left and right handed handset usage, as well as body-worn usage using the flat phantom region. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. The shell phantom has a 2mm shell thickness (except the ear region where shell thickness increases to 6 mm).

7.2 Tissue Simulating Mixture Characterization

Figure 7-2
SAM Phantom with Simulating Tissue

The mixture is characterized to obtain proper dielectric constant (permittivity) and conductivity of the tissue of interest. The tissue dielectric parameters recommended in IEEE 1528 and IEC 62209 have been used as targets for the compositions, and are to match within 5%, per the FCC recommendations.

Table 7-1
Composition of the Tissue Equivalent Matter

Frequency (MHz)	835	1900	2450	5200-5800
Tissue	Body	Body	Body	Body
Ingredients (% by weight)				
Bactericide	0.1			
DGBE		29.44	26.7	
HEC	1			
NaCl	0.94	0.39	0.1	
Sucrose	44.9			
Triton X-100				10.67
Diethylenglycol monohexylether				10.67
Water	53.06	70.17	73.2	78.66

See next page for 750MHz Information

Table 7-2
Composition of the 750MHz Body Tissue Equivalent Matter

=

2 Composition / Information on ingredients

The Item is composed of the following ingredients:

H_2O	Water, 35 – 58%
Sucrose	Sugar, white, refined, 40 – 60%
NaCl	Sodium Chloride, 0 – 6%
Hydroxyethyl-cellulose	Medium Viscosity (CAS# 9004-62-0), <0.3%
Preventol-D7	Preservative: aqueous preparation, (CAS# 55965-84-9), containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyyl-3(2H)-isothiazolone, 0.1 – 0.7%
	Relevant for safety; Refer to the respective Safety Data Sheet*.

Note: 750MHz Body liquid recipe is proprietary SPEAG. The composition is approximate to the actual liquids utilized. Thus the manufacturer production sheet is provided below.

Figure 7-1
750MHz Body Tissue Equivalent Matter

f [MHz]	HP-e'	HP-e"	sigma
300	61.02	35.43	0.59
350	60.21	32.13	0.63
400	59.50	29.71	0.66
450	58.79	28.00	0.70
500	58.16	26.60	0.74
550	57.57	25.54	0.78
600	56.99	24.68	0.82
650	56.43	23.97	0.87
700	55.88	23.46	0.91
750	55.35	22.91	0.96
800	55.02	22.56	1.00
850	54.50	22.31	1.06
900	54.02	22.08	1.11
950	53.55	21.89	1.16
1000	53.05	21.70	1.21

P/N:	SL AAM 075
Charge:	090224-1
Mea Date:	05-Mrz-09
Temp [°C]	22

TARGET PARAMETERS		
f [MHz]	eps	sigma
700	55.7	0.96
750	55.5	0.96
800	55.3	0.97

8 DOSIMETRIC ASSESSMENT & PHANTOM SPECS

8.1 Measurement Procedure

The evaluation was performed using the following procedure:

1. The SAR distribution at the exposed side of the head was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 15mm x 15mm.
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during testing the 1 gram cube. This fixed point was measured and used as a reference value.
3. Based on the area scan data, the area of the maximum absorption was determined by spline interpolation. Around this point, a volume of 32mm x 32mm x 30mm (fine resolution volume scan, zoom scan) was assessed by measuring 5 x 5 x 7 points. On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual for more details):
   a. The data was extrapolated to the surface of the outer-shell of the phantom. The combined distance extrapolated was the combined distance from the center of the dipoles 2.7mm away from the tip of the probe housing plus the 1.2 mm distance between the surface and the lowest measuring point. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).
   b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.
   c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete. If the value deviated by more than 5%, the evaluation was repeated.
5. For 5 GHz testing finer resolution zoom scans were preformed as specified by FCC SAR Measurement Requirements for 3 – 6 GHz, KDB pub 865664. The 5 GHz zoom scan requires a minimum volume of 24mm x 24mm x 20mm and 7 x 7 x 11 points.

8.2 Specific Anthropomorphic Mannequin (SAM) Specifications

The phantom for handset SAR assessment testing is a low-loss dielectric shell, with shape and dimensions derived from the anthropometric data of the 90th percentile adult male head dimensions as tabulated by the US Army. The SAM Twin Phantom shell is bisected along the mid-sagittal plane into right and left halves (see Figure 8-1). The perimeter sidewalls of each phantom halves are extended to allow filling with liquid to a depth that is sufficient to minimize reflections from the upper surface. The liquid depth is maintained at a minimum depth of 15 cm.

Figure 8-1
SAM Twin Phantom Shell

9 FCC RF EXPOSURE LIMITS

9.1 Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

9.2 Controlled Environment

CONTROLLED ENVIRONMENTS are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table 9-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (W/kg) or (mW/g)
SPATIAL PEAK SAR Brain	1.6	8.0
SPATIAL AVERAGE SAR Whole Body	0.08	0.4
SPATIAL PEAK SAR Hands, Feet, Ankles, Wrists	4.0	20

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

10 FCC 2G/3G MEASUREMENT PROCEDURES

10.1 Procedures Used to Establish RF Signal for SAR

The device was placed into a simulated call using a base station simulator in a shielded chamber. Such test signals offer a consistent means for testing SAR and are recommended for evaluating SAR [4]. SAR measurements were taken with a fully charged battery. In order to verify that the device was tested and maintained at full power, it was configured with the base station simulator. The SAR measurement software calculates a reference point at the start and end of the test to check for power drifts. If SAR deviations of more than 5% occurred, the tests were repeated.

10.2 SAR Measurement Conditions for CDMA2000

The following procedures were performed according to FCC "SAR Measurement Procedures for 3G Devices" v02, October 2007.

10.2.1 Output Power Verification

See 3GPP2 C.S0011/TIA-98-E as recommended by "SAR Measurement Procedures for 3G Devices" v02, October 2007. Maximum output power is verified on the High, Middle and Low channels according to procedures in section 4.4.5.2 of 3GPP2 C.S0011/TIA-98-E. SO55 tests were measured with power control bits in the "All Up" condition.

1. If the mobile station (MS) supports Reverse TCH RC 1 and Forward TCH RC 1, set up a call using Fundamental Channel Test Mode 1 (RC=1/1) with 9600 bps data rate only.
2. Under RC1, C.S0011 Table 4.4.5.2-1, Table 10-1 parameters were applied.
3. If the MS supports the RC 3 Reverse FCH, RC3 Reverse SCH_0 and demodulation of RC 3,4, or 5, set up a call using Supplemental Channel Test Mode 3 (RC 3/3) with 9600 bps Fundamental Channel and 9600 bps SCH0 data rate.
4. Under RC3, C.S0011 Table 4.4.5.2-2, Table 13-2 was applied.
5. FCHs were configured at full rate for maximum SAR with "All Up" power control bits.

Table 10-1
Parameters for Max. Power for RC1

Parameter	Units	Value
$\hat{I}_{or}$	dBm/1.23 MHz	-104
$\frac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\frac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

Table 10-2
Parameters for Max. Power for RC3

Parameter	Units	Value
$\hat{I}_{or}$	dBm/1.23 MHz	-86
$\frac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\frac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

10.2.2 Body SAR Measurements for EVDO Data Devices

Body SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0. SAR for Subtype 2 Physical layer configurations is not required for Rev. A when the maximum average output of each RF channels is less than that measured in Subtype 0/1 Physical layer configurations. Otherwise, SAR is measured on the maximum output channel for Rev. A using the exposure configuration that results in the highest SAR for the RF channels in Rev. 0. The AT is tested with a Reverse Data Channel rate of 153.6 kbps in Subtype 0/1 Physical Layer configurations; and a Reverse Data Channel payload size of 4096 bits and Termination Target of 16 slots in Subtype 2 Physical Layer configurations. Both FTAP and FETAP are configured with a Forward Traffic Channel data rate corresponding to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in all slots. AT power control should be in "All Bits Up" conditions for TAP/ETAP.

10.3 SAR Measurement Conditions for UMTS

10.4 SAR Measurement Conditions for HSPA Data Devices

10.4.1 Body SAR Measurements

SAR for body exposure configurations are measured according to the ‘Body SAR Measurements’ procedures in the ‘WCDMA Handsets’ section of the FCC 3G document. In addition, body SAR is also measured for HSPA when the maximum average output of each RF channel with HSPA active is at least ¼ dB higher than that measured without HSPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 with power control algorithm 2, according to the highest body SAR configuration in 12.2 kbps RMC without HSPA.

Due to inner loop power control requirements in HSPA, a commercial communication test set should be used for the output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and EDCH configurations for HSPA should be configured according to the β values indicated below as well as other applicable procedures described in the ‘WCDMA Handset’ and ‘Release 5 HSDPA Data Devices’ sections of the FCC 3G document.

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM(2) (dB)	MPR (dB)	AG(4) Index	E-TFCI
1	11/15(3)	15/15(3)	64	11/15(3)	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}: 47/15 β_{ed2}: 47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15(4)	15/15(4)	64	15/15(4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$.

Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.

Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.

Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g.

Note 6: β_{ed} can not be set directly; it is set by Absolute Grant Value.

10.5 RF Conducted Powers

10.5.1 CDMA/EVDO Conducted Powers

Band	Channel	TDSO SO32 [dBm]	TDSO SO32 [dBm]	1x EvDO Rev. 0 [dBm]	1x EvDO Rev. A [dBm]
	F-RC	FCH+SCH	FCH	(RTAP)	(RETAP)
Cellular	1013	25.09	25.03	25.15	25.34
	384	25.05	25.02	25.11	25.17
	777	24.83	24.79	24.87	24.89
PCS	25	24.70	24.62	24.77	24.63
	600	24.48	24.55	24.41	24.42
	1175	24.26	24.25	24.32	24.29

Note: It was confirmed with the manufacturer that the device used for SAR testing with the measured output powers was not overdriven to non-linear operations.

10.5.2 GPRS/EDGE Conducted Powers

		Maximum Burst-Average Output Power									
		GPRS Data (GMSK)		*EDGE Data (GMSK)*				*EDGE Data (8PSK)*			
Band	Channel	GPRS [dBm] 1 Tx Slot	GPRS [dBm] 2 Tx Slot	EDGE [dBm] 1 Tx Slot	EDGE [dBm] 2 Tx Slot	EDGE [dBm] 3 Tx Slot	EDGE [dBm] 4 Tx Slot	EDGE [dBm] 1 Tx Slot	EDGE [dBm] 2 Tx Slot	EDGE [dBm] 3 Tx Slot	EDGE [dBm] 4 Tx Slot
Cellular	128	32.29	**31.67**	32.30	31.50	28.65	26.78	25.73	25.66	25.62	24.46
	190	32.31	**31.98**	32.33	31.60	28.41	26.73	25.87	25.82	25.65	25.61
	251	32.18	**31.57**	32.25	31.51	28.82	26.74	26.06	25.74	25.78	25.57
PCS	512	30.24	**29.47**	29.89	29.18	26.02	24.38	25.96	25.89	25.74	24.42
	661	30.06	**29.34**	29.97	29.29	26.27	24.51	25.81	25.77	25.53	24.33
	810	29.97	**29.18**	30.02	29.44	25.99	24.23	25.62	25.53	25.48	24.08

		Maximum Frame-Average Output Power									
		GPRS Data		*EDGE Data*				*EDGE Data*			
Band	Channel	GPRS [dBm] 1 Tx Slot	GPRS [dBm] 2 Tx Slot	EDGE [dBm] 1 Tx Slot	EDGE [dBm] 2 Tx Slot	EDGE [dBm] 3 Tx Slot	EDGE [dBm] 4 Tx Slot	EDGE [dBm] 1 Tx Slot	EDGE [dBm] 2 Tx Slot	EDGE [dBm] 3 Tx Slot	EDGE [dBm] 4 Tx Slot
Cellular	128	23.26	**25.65**	23.27	25.48	24.39	23.77	16.70	19.64	21.36	21.45
	190	23.28	**25.96**	23.30	25.58	24.15	23.72	16.84	19.80	21.39	22.60
	251	23.15	**25.55**	23.22	25.49	24.56	23.73	17.03	19.72	21.52	22.56
PCS	512	21.21	**23.45**	20.86	23.16	21.76	21.37	16.93	19.87	21.48	21.41
	661	21.03	**23.32**	20.94	23.27	22.01	21.50	16.78	19.75	21.27	21.32
	810	20.94	**23.16**	20.99	23.42	21.73	21.22	16.59	19.51	21.22	21.07

Note: Both burst-averaged and frame-averaged powers are included. The bolded GPRS/EDGE mode was selected according to the highest frame-averaged output power table according to KDB 941225 D03.

GPRS powers were measured with CS1. EDGE (GMSK) powers were measured with MCS4 while EDGE (8PSK) powers were measured with MCS7.

Note: It was confirmed with the manufacturer that the device used for SAR testing with the measured output powers was not overdriven to non-linear operations.

GSM Class: C (Data only)
GPRS Multislot class: 10 (max 2 Tx Uplink slots)
EDGE Multislot class: 12 (max 4 Tx Uplink slots)
DTM Multislot Class: N/A

10.5.3 UMTS Conducted Powers

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			PCS Band [dBm]			βc	βd	MPR
			4132	4183	4233	9262	9400	9538			
99	WCDMA	12.2 kbps RMC	22.40	22.68	**22.85**	22.72	22.56	**22.75**	-	-	-
6	HSDPA	Subtest 1	21.88	22.00	22.25	21.75	22.05	**22.28**	2	15	0
6		Subtest 2	21.68	**22.14**	**22.40**	21.71	22.07	22.22	11	15	0
6		Subtest 3	21.08	21.67	21.85	21.23	21.54	21.85	15	8	0.5
6		Subtest 4	21.57	21.83	22.00	21.36	21.65	21.89	15	4	0.5
6	HSUPA	Subtest 1	21.16	21.65	21.67	21.14	21.23	21.64	10	15	0
6		Subtest 2	20.15	20.81	20.82	20.55	20.58	21.04	6	15	2
6		Subtest 3	20.26	21.09	20.89	20.69	20.79	21.06	15	9	1
6		Subtest 4	20.29	21.10	21.49	21.00	21.11	21.35	2	15	2
6		Subtest 5	20.86	21.41	**21.76**	21.00	**21.93**	21.49	14	15	0

It is expected by the chipset manufacturer that MPR for some HSUPA subtests may be up to 1 dB more than specified by 3GPP, but also as low as 0 dB according to the chipset implementation in this model. Information is included in the operational description explaining how the MPR is applied.

11 SAR TESTING WITH IEEE 802.11 TRANSMITTERS

Normal network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g transmitters. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable according to KDB 248227.

11.1 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

11.2 Frequency Channel Configurations [27]

802.11 a/b/g and 4.9 GHz operating modes are tested independently according to the service requirements in each frequency band. 802.11 b/g modes are tested on channels 1, 6 and 11. 802.11a is tested for UNII operations on channels 36 and 48 in the 5.15-5.25 GHz band; channels 52 and 64 in the 5.25-5.35 GHz band; channels 104, 116, 124 and 136 in the 5.470-5.725 GHz band; and channels 149 and 161 in the 5.8 GHz band. When 5.8 GHz §15.247 is also available, channels 149, 157 and 165 should be tested instead of the UNII channels. 4.9 GHz is tested on channels 1, 10 and 5 or 6, whichever has the higher output power, for 5 MHz channels; channels 11, 15 and 19 for 10 MHz channels; and channels 21 and 25 for 20 MHz channels. These are referred to as the “default test channels”. 802.11g mode was evaluated only if the output power was 0.25 dB higher than the 802.11b mode.

Table 11-1
802.11 Test Channels per FCC Requirements

Mode		GHz	Channel	Turbo Channel	"Default Test Channels"			
					§15.247		UNII	
					802.11b	802.11g		
802.11 b/g		2.412	1		√	∇		
		2.437	6	6	√	∇		
		2.462	11		√	∇		
802.11a	UNII	5.18	36				√	
		5.20	40	42 (5.21 GHz)				*
		5.22	44					*
		5.24	48	50 (5.25 GHz)			√	
		5.26	52				√	
		5.28	56	58 (5.29 GHz)				*
		5.30	60					*
		5.32	64				√	
		5.500	100	Unknown				*
		5.520	104				√	
		5.540	108					*
		5.560	112					*
		5.580	116				√	
		5.600	120					*
		5.620	124				√	
		5.640	128					*
		5.660	132					*
		5.680	136				√	
		5.700	140					*
	UNII or §15.247	5.745	149		√		√	
		5.765	153	152 (5.76 GHz)		*		*
		5.785	157		√			*
		5.805	161	160 (5.80 GHz)		*	√	
	§15.247	5.825	165		√			

Table 11-2
IEEE 802.11b Average RF Power

Mode	Freq [MHz]	Channel	Tx Chain	Conducted Power [dBm] Data Rate [Mbps] 1	2	5.5	11
802.11b	2412	1	1	13.08	12.96	13.00	12.90
802.11b	2437	6	1	14.00	14.01	14.14	14.01
802.11b	2462	11	1	13.82	13.80	13.89	13.76

Mode	Freq [MHz]	Channel	Tx Chain	Conducted Power [dBm] Data Rate [Mbps] 1	2	5.5	11
802.11b	2412	1	2	13.14	13.13	13.12	13.10
802.11b	2437	6	2	14.08	14.10	14.09	14.10
802.11b	2462	11	2	13.79	13.70	13.75	13.77

Table 11-3
IEEE 802.11g Average RF Power

Mode	Freq [MHz]	Channel	Tx Chain	Conducted Power [dBm] Data Rate [Mbps] 6.5	13	20	26	39	52	58	65
802.11g	2412	1	1	12.82	12.72	12.75	12.75	12.57	12.50	12.50	11.96
802.11g	2417	2	1	15.50	15.25	15.20	15.30	15.10	15.10	13.65	12.10
802.11g	2437	6	1	15.64	15.54	15.55	15.54	15.35	15.27	13.67	11.85
802.11g	2457	10	1	15.55	15.15	15.14	15.30	15.11	14.77	13.50	11.40
802.11g	2462	11	1	12.36	12.38	12.37	12.36	12.25	12.13	12.19	12.05

Mode	Freq [MHz]	Channel	Tx Chain	Conducted Power [dBm] Data Rate [Mbps] 6	9	12	18	24	36	48	54
802.11g	2412	1	2	11.94	11.95	11.97	12.06	11.85	11.91	12.06	12.03
802.11g	2417	2	2	15.00	14.90	14.85	14.86	14.72	14.32	13.25	11.50
802.11g	2437	6	2	15.16	15.10	15.09	15.14	14.97	15.03	13.62	11.41
802.11g	2457	10	2	13.63	14.00	13.82	13.92	13.70	13.75	12.45	10.70
802.11g	2462	11	2	11.30	11.34	11.33	11.38	11.26	11.27	11.33	11.36

Table 11-4
IEEE 802.11n 20 MHz Bandwidth Average RF Power

Mode	Freq [MHz]	Channel	BW [MHz]	Tx Chain	2.4GHz 802.11n (20MHz BW) Conducted Power [dBm] Data Rate [Mbps] 6.5	13	20	26	39	52	58	65
802.11n	2412	1	20	1	12.57	12.43	12.43	12.40	12.33	12.36	11.81	10.30
802.11n	2417	2	20	1	15.21	15.17	15.00	14.95	14.90	13.62	11.75	10.40
802.11n	2437	6	20	1	15.42	15.29	15.37	15.35	15.26	14.00	11.73	10.23
802.11n	2457	10	20	1	14.60	14.88	14.95	14.90	14.90	13.15	11.10	10.18
802.11n	2462	11	20	1	12.23	12.05	12.20	12.14	12.05	12.03	11.90	10.35

Mode	Freq [MHz]	Channel	BW [MHz]	Tx Chain	Conducted Power [dBm] Data Rate [Mbps] 6.5	13	20	26	39	52	58	65
802.11n	2412	1	20	2	11.72	11.65	11.83	11.82	11.88	11.90	11.83	10.59
802.11n	2417	2	20	2	14.97	14.25	14.45	14.82	14.70	12.80	11.20	9.62
802.11n	2437	6	20	2	15.10	15.03	15.04	15.07	15.09	13.42	11.33	10.23
802.11n	2457	10	20	2	13.50	13.55	13.83	13.57	13.75	12.66	10.90	9.25
802.11n	2462	11	20	2	11.07	11.01	11.03	11.15	11.19	11.22	11.24	9.64

Table 11-5
IEEE 802.11n 40 MHz Bandwidth Average RF Power

Mode	Freq [MHz]	Channel	BW [MHz]	Tx Chain	2.4GHz 802.11n (40MHz BW) Conducted Power [dBm]							
					Data Rate [Mbps]							
					6.5	13	20	26	39	52	58	65
802.11n	2422	1	40	1	8.47	8.50	8.43	8.38	8.41	8.46	8.49	8.48
802.11n	2417	2	40	1	10.75	10.53	10.55	10.50	10.51	10.50	10.60	10.55
802.11n	2437	6	40	1	15.78	15.57	15.57	15.44	15.49	13.89	12.50	11.01
802.11n	2447	8	40	1	7.60	7.63	7.58	7.46	7.50	7.48	7.67	7.55
802.11n	2452	11	40	1	7.72	7.79	7.79	7.70	7.76	7.80	7.89	7.86

Mode	Freq [MHz]	Channel	BW [MHz]	Tx Chain	2.4GHz 802.11n (40MHz BW) Conducted Power [dBm]							
					Data Rate [Mbps]							
					6.5	13	20	26	39	52	58	65
802.11n	2422	1	40	2	8.00	8.15	7.79	7.61	7.53	7.52	7.51	7.45
802.11n	2417	2	40	2	10.20	10.41	10.02	10.21	9.95	9.92	10.02	9.97
802.11n	2437	6	40	2	15.56	15.28	15.18	15.00	14.53	13.16	11.40	9.89
802.11n	2447	8	40	2	7.66	8.05	7.98	7.95	7.80	7.90	8.11	8.05
802.11n	2452	11	40	2	7.39	7.35	7.30	7.17	7.01	6.98	7.01	6.83

According to KDB 248227 D01 Page 4, "802.11b/g modes are tested on channels 1,6,11; however, if output power reduction is necessary for channels 1 and/or 11 to meet restricted band requirements the highest output channels closest to each of these channels must be tested instead."

Table 11-6
IEEE 802.11a Average RF Power

Mode	Freq [MHz]	Channel	BW [MHz]	Tx Chain	802.11a (20MHz) Conducted Power [dBm]							
					Data Rate [Mbps]							
					6	9	12	18	24	36	48	54
802.11a	**5180**	**36**	20	1	13.43	13.06	13.36	13.33	13.22	12.86	13.18	11.42
802.11a	5200	40	20	1	14.83	14.82	14.75	14.76	14.61	14.55	13.76	11.53
802.11a	5220	44	20	1	14.70	14.74	14.71	14.72	14.55	14.16	13.70	11.50
802.11a	**5240**	**48**	20	1	14.64	14.63	14.55	14.61	14.79	14.30	13.54	11.39
802.11a	**5260**	**52**	20	1	14.64	14.57	14.54	14.55	14.28	14.26	13.40	11.65
802.11a	5280	56	20	1	14.73	14.72	14.68	14.72	14.56	14.52	13.64	11.43
802.11a	5300	60	20	1	14.58	14.50	14.53	14.55	14.34	14.34	13.49	11.73
802.11a	**5320**	**64**	20	1	15.01	14.92	14.85	14.87	14.71	14.65	13.72	11.56
802.11a	5500	100	20	1	15.40	15.58	15.35	15.22	15.00	14.96	14.14	12.11
802.11a	**5520**	**104**	20	1	15.22	15.14	15.12	15.19	15.08	15.14	14.16	11.97
802.11a	5540	108	20	1	15.05	14.99	14.97	15.05	14.94	15.20	14.15	11.78
802.11a	5560	112	20	1	14.80	14.80	14.77	14.83	14.70	14.71	13.75	11.49
802.11a	**5580**	**116**	20	1	14.43	14.47	14.41	14.50	14.45	14.42	13.77	11.33
802.11a	5600	120	20	1	14.31	14.20	14.10	13.97	13.98	13.90	13.16	10.87
802.11a	**5620**	**124**	20	1	14.12	13.98	13.71	13.79	13.63	13.66	13.01	11.06
802.11a	5640	128	20	1	14.06	13.97	13.92	13.98	13.88	13.90	12.88	11.18
802.11a	5660	132	20	1	14.02	14.04	14.03	14.12	14.02	13.98	13.25	11.05
802.11a	**5680**	**136**	20	1	14.05	13.95	13.94	14.01	13.93	13.93	13.35	11.31
802.11a	5700	140	20	1	14.11	14.07	14.05	14.11	14.02	14.03	13.35	11.01
802.11a	**5745**	**149**	20	1	13.73	13.73	13.73	13.75	13.71	13.68	13.07	10.62
802.11a	5765	153	20	1	13.68	13.67	13.67	13.58	13.52	13.56	12.83	10.29
802.11a	**5785**	**157**	20	1	13.55	13.43	13.54	13.60	13.50	13.53	12.80	10.35
802.11a	**5805**	**161**	20	1	13.52	13.50	13.49	13.58	13.45	13.48	12.28	10.22
802.11a	5825	165	20	1	13.32	13.38	13.35	13.34	13.31	13.32	12.13	10.18

Mode	Freq [MHz]	Channel	BW [MHz]	Tx Chain	Conducted Power [dBm]							
					Data Rate [Mbps]							
					6	9	12	18	24	36	48	54
802.11a	**5180**	**36**	20	2	14.43	14.39	14.12	14.14	14.32	14.14	14.28	12.32
802.11a	5200	40	20	2	15.92	15.47	15.11	15.61	15.37	15.81	14.15	12.17
802.11a	5220	44	20	2	15.77	15.73	15.71	15.77	15.65	15.67	14.51	12.78
802.11a	**5240**	**48**	20	2	15.63	16.00	15.98	16.02	15.80	15.89	14.74	12.62
802.11a	**5260**	**52**	20	2	15.57	15.76	15.61	15.70	15.45	15.48	14.74	12.96
802.11a	5280	56	20	2	15.78	15.75	15.79	15.70	15.59	15.58	14.85	13.09
802.11a	5300	60	20	2	15.67	15.77	15.70	15.79	15.65	15.78	15.07	12.81
802.11a	**5320**	**64**	20	2	16.06	15.98	15.96	16.05	16.00	15.74	14.98	12.71
802.11a	5500	100	20	2	16.81	16.85	16.82	16.86	16.77	16.67	15.83	13.95
802.11a	**5520**	**104**	20	2	16.68	16.69	16.71	16.72	16.53	16.52	15.61	13.76
802.11a	5540	108	20	2	16.46	16.48	16.52	16.59	16.54	16.49	15.59	13.79
802.11a	5560	112	20	2	16.26	16.26	16.27	16.34	16.29	16.33	15.37	13.53
802.11a	**5580**	**116**	20	2	15.92	15.80	15.77	15.86	15.60	15.60	14.82	12.88
802.11a	5600	120	20	2	15.48	15.46	15.45	15.47	15.33	15.46	14.47	12.44
802.11a	**5620**	**124**	20	2	15.33	15.29	15.22	15.31	14.91	15.25	14.32	12.32
802.11a	5640	128	20	2	15.27	15.24	15.25	15.26	15.20	15.03	14.31	12.34
802.11a	5660	132	20	2	15.32	15.31	15.28	15.35	15.25	15.04	14.40	12.41
802.11a	**5680**	**136**	20	2	15.31	15.30	15.27	15.28	15.26	15.29	14.55	12.53
802.11a	5700	140	20	2	15.16	15.13	15.18	15.21	15.17	15.13	14.51	12.49
802.11a	**5745**	**149**	20	2	14.90	14.95	14.96	15.01	14.93	14.92	13.86	12.09
802.11a	5765	153	20	2	14.50	14.56	14.63	14.68	14.54	14.59	13.90	12.14
802.11a	**5785**	**157**	20	2	14.59	14.50	14.45	14.48	14.38	14.42	13.71	11.60
802.11a	**5805**	**161**	20	2	14.37	14.41	14.36	14.35	14.33	14.00	13.41	11.57
802.11a	5825	165	20	2	13.93	13.95	13.95	13.99	13.94	13.92	13.31	11.44

Table 11-7
IEEE 802.11n 20 MHz Bandwidth Average RF Power

Mode	Freq [MHz]	Channel	BW [MHz]	Tx Chain	802.11n (20MHz) Conducted Power [dBm] Data Rate [Mbps]							
					6.5	13	20	26	39	52	58	65
802.11n	**5180**	**36**	20	1	13.31	13.12	13.20	13.18	13.12	13.05	11.30	9.34
802.11n	5200	40	20	1	14.79	14.64	14.70	14.61	14.52	13.70	11.50	9.66
802.11n	5220	44	20	1	14.64	14.45	14.53	14.45	14.43	13.54	11.36	9.53
802.11n	**5240**	**48**	20	1	14.56	14.46	14.48	14.47	14.45	13.53	11.32	9.47
802.11n	**5260**	**52**	20	1	14.85	14.30	14.35	14.25	14.18	13.30	11.55	9.75
802.11n	5280	56	20	1	14.63	14.48	14.56	14.58	14.50	13.57	11.43	9.58
802.11n	5300	60	20	1	14.47	14.35	14.45	14.42	14.31	13.41	11.70	9.88
802.11n	**5320**	**64**	20	1	14.81	14.64	14.74	14.68	14.58	13.60	11.41	10.06
802.11n	5500	100	20	1	15.28	15.08	15.39	15.29	15.50	14.15	12.37	10.63
802.11n	**5520**	**104**	20	1	15.22	14.88	14.87	15.22	15.14	14.01	12.26	10.51
802.11n	5540	108	20	1	15.06	14.79	14.89	14.97	14.96	13.84	11.67	10.29
802.11n	5560	112	20	1	14.73	14.58	14.65	14.65	14.77	13.62	11.85	10.06
802.11n	**5580**	**116**	20	1	14.41	14.41	14.46	14.46	14.37	13.35	11.28	9.67
802.11n	5600	120	20	1	13.98	14.12	14.16	14.12	13.94	13.00	11.01	9.22
802.11n	**5620**	**124**	20	1	13.83	13.73	13.64	13.60	13.62	12.87	10.77	9.20
802.11n	5640	128	20	1	13.84	13.78	13.86	13.90	13.93	12.80	11.04	9.23
802.11n	5660	132	20	1	13.92	13.87	14.01	14.04	14.08	13.24	11.23	9.26
802.11n	**5680**	**136**	20	1	13.90	13.81	13.87	13.92	13.92	13.19	11.31	9.48
802.11n	5700	140	20	1	14.02	13.92	13.98	13.99	14.06	13.31	11.04	9.01
802.11n	**5745**	**149**	20	1	13.57	13.55	13.59	13.66	13.69	12.96	10.62	9.21
802.11n	5765	153	20	1	13.44	13.42	13.47	13.53	13.53	12.71	10.80	8.92
802.11n	**5785**	**157**	20	1	13.48	13.38	13.48	13.50	13.55	12.72	10.31	8.88
802.11n	**5805**	**161**	20	1	13.42	13.41	13.41	13.46	13.46	12.53	10.23	8.56
802.11n	5825	165	20	1	13.21	13.04	13.20	13.20	13.23	12.33	10.18	8.49

Mode	Freq [MHz]	Channel	BW [MHz]	Tx Chain	Conducted Power [dBm] Data Rate [Mbps]							
					6.5	13	20	26	39	52	58	65
802.11n	**5180**	**36**	20	2	14.01	14.40	14.47	14.48	14.00	14.14	12.36	10.56
802.11n	5200	40	20	2	14.57	14.43	14.97	15.49	15.18	14.39	12.36	10.92
802.11n	5220	44	20	2	15.50	15.30	15.50	15.58	15.11	14.29	12.59	10.80
802.11n	**5240**	**48**	20	2	15.50	15.36	15.41	15.43	15.47	14.53	13.03	10.65
802.11n	**5260**	**52**	20	2	15.71	15.16	15.30	15.35	15.63	14.49	12.79	10.59
802.11n	5280	56	20	2	15.65	15.61	15.58	15.60	15.56	15.09	13.06	11.24
802.11n	5300	60	20	2	15.47	15.34	15.46	15.44	15.73	14.96	12.82	11.40
802.11n	**5320**	**64**	20	2	16.02	15.82	15.91	15.96	15.66	15.23	12.65	10.96
802.11n	5500	100	20	2	16.60	16.38	16.20	16.76	16.77	15.40	13.51	12.05
802.11n	**5520**	**104**	20	2	16.19	15.99	16.11	16.67	16.50	15.80	13.35	11.52
802.11n	5540	108	20	2	16.66	16.11	16.58	16.30	16.19	15.53	13.64	11.79
802.11n	5560	112	20	2	16.11	15.93	16.06	16.08	16.04	15.10	13.30	11.77
802.11n	**5580**	**116**	20	2	15.94	15.58	15.32	15.42	15.38	14.57	12.53	10.72
802.11n	5600	120	20	2	15.41	15.36	15.45	15.47	15.13	14.34	12.22	10.06
802.11n	**5620**	**124**	20	2	15.02	14.89	14.99	15.00	15.01	14.14	12.62	10.35
802.11n	5640	128	20	2	14.67	14.50	14.64	14.96	14.66	13.55	11.82	9.99
802.11n	5660	132	20	2	15.34	14.52	15.09	15.02	15.45	14.23	12.21	10.38
802.11n	**5680**	**136**	20	2	15.15	15.38	15.38	14.73	15.13	14.29	12.30	10.57
802.11n	5700	140	20	2	15.27	15.10	15.19	14.82	15.25	14.36	11.91	10.56
802.11n	**5745**	**149**	20	2	14.41	14.75	14.85	14.90	14.83	14.15	12.04	10.26
802.11n	5765	153	20	2	14.50	14.37	14.42	14.41	14.11	13.77	11.90	10.18
802.11n	**5785**	**157**	20	2	13.71	13.63	14.17	14.30	14.39	13.73	11.45	10.60
802.11n	**5805**	**161**	20	2	14.08	13.51	13.68	13.62	13.71	12.82	10.95	9.72
802.11n	5825	165	20	2	13.21	13.82	13.86	13.60	13.59	12.71	10.91	9.06

Table 11-8
IEEE 802.11n 40 MHz Bandwidth Average RF Power

Mode	Freq [MHz]	Channel	BW [MHz]	Tx Chain	802.11n (40MHz) Conducted Power [dBm]							
					Data Rate [Mbps]							
					6.5	13	20	26	39	52	58	65
802.11n	**5190**	**38**	40	1	9.99	9.95	9.93	9.82	9.95	9.97	10.04	10.02
802.11n	**5230**	**46**	40	1	13.57	13.90	13.99	13.93	13.54	13.19	11.58	9.73
802.11n	**5270**	**54**	40	1	14.34	14.31	14.25	14.09	14.29	13.90	11.84	10.05
802.11n	**5310**	**62**	40	1	11.28	11.29	11.28	11.24	11.30	11.35	11.42	10.21
802.11n	5510	102	40	1	13.82	13.74	13.56	13.68	13.76	13.78	12.22	10.77
802.11n	5550	110	40	1	14.63	14.67	14.89	14.81	14.57	13.82	11.79	10.41
802.11n	**5590**	**118**	40	1	13.96	14.23	14.13	14.05	14.11	13.33	11.35	9.39
802.11n	**5630**	**126**	40	1	13.66	13.71	13.68	13.66	13.67	12.94	10.88	8.97
802.11n	5670	134	40	1	13.90	13.88	13.87	13.79	13.83	13.07	11.14	9.64
802.11n	**5755**	**151**	40	1	13.86	13.99	13.92	13.56	13.99	12.72	10.93	9.08
802.11n	5795	159	40	1	13.51	13.52	13.47	13.04	13.49	12.35	10.51	9.12

Mode	Freq [MHz]	Channel	BW [MHz]	Tx Chain	802.11n (40MHz) Conducted Power [dBm]							
					Data Rate [Mbps]							
					6.5	13	20	26	39	52	58	65
802.11n	**5190**	**38**	40	2	10.55	10.83	9.86	9.85	10.00	9.66	9.80	9.62
802.11n	**5230**	**46**	40	2	13.81	14.31	14.15	13.95	13.84	13.25	11.07	9.66
802.11n	**5270**	**54**	40	2	14.87	14.94	15.15	14.51	14.51	13.47	11.60	10.26
802.11n	**5310**	**62**	40	2	11.66	11.69	11.51	11.36	11.31	11.23	11.25	10.35
802.11n	5510	102	40	2	14.43	14.70	14.63	14.34	14.23	14.18	12.57	11.04
802.11n	5550	110	40	2	15.88	15.86	15.84	15.57	15.45	14.24	12.78	10.82
802.11n	**5590**	**118**	40	2	15.48	15.41	15.35	14.78	14.71	13.51	11.89	9.93
802.11n	**5630**	**126**	40	2	14.51	15.12	14.23	14.43	14.40	13.59	11.19	9.74
802.11n	5670	134	40	2	14.91	14.88	15.10	14.50	14.51	13.72	11.25	9.76
802.11n	**5755**	**151**	40	2	14.70	14.04	13.89	14.00	14.11	13.07	11.02	9.53
802.11n	5795	159	40	2	13.91	13.93	13.40	13.53	13.55	12.46	10.89	9.32

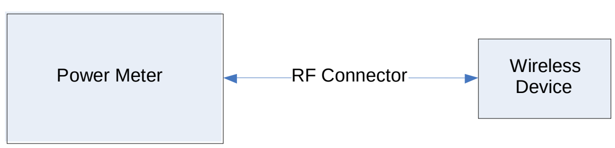

Figure 11-1
Power Measurement Setup

12 4G LTE TEST CONFIGURATIONS

12.1 Frequency of Operation per 27.5

Per FCC Rule 27.5(b)(3): “(3) Two paired channels of 11 megahertz each are available for assignment in Block C in the 746-757 MHz and 776-787 MHz bands.”

12.2 Test Conditions

SAR tests for LTE were performed with a base station simulator, Rohde & Schwarz CMW500. Closed loop power control was used so the UE transmits with maximum output power during SAR testing.

12.3 LTE Measured Maximum RF Output Conducted Powers

All powers were measured with the CMW500. This device supports both 5 MHz and 10 MHz bandwidths. For 10 MHz, there is one channel (782 MHz).

There is a permanently applied MPR implemented by the module when implemented in the laptop. With the MPR permanently implemented, this device will never operate at higher power levels than that indicated in the Tune up procedure. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1. See LTE SAR Data tables in Section 14 for specific MPR per mode and configuration.

A-MPR has been disabled for all SAR Tests. LTE modes were selected according to LTE procedures in FCC KDB 941225 D05 publication. Please see notes following SAR data for required test configurations.

Table 12-1
Measured LTE RF Output Powers – 10 MHz BW

Frequency	CH	BW	Modulation	RB Size	RB Offset	Maximum Average Power [dBm]	Target MPR (dB)	MPR Per 3GPP (dB)
782 MHz	23230	10 MHz	QPSK	1	0	24.00	0	0
			16QAM	1	0	23.40	1	0 ~ 1
			QPSK	1	49	23.59	0	0
			16QAM	1	49	23.14	1	0 ~ 1
			QPSK	25	12	22.63	1	0 ~ 1
			16QAM	25	12	22.40	2	0 ~ 2
			QPSK	50	0	22.49	1	0 ~ 1
			16QAM	50	0	21.43	2	0 ~ 2

Table 12-2
Measured LTE RF Output Powers – 5 MHz BW

Frequency	CH	BW	Modulation	RB Size	RB Offset	Maximum Average Power [dBm]	Target MPR (dB)	MPR Per 3GPP (dB)
779.5	23206	5 MHz	QPSK	1	0	23.88	0	0
			16QAM	1	0	22.97	1	0 ~ 1
			QPSK	1	24	23.71	0	0
			16QAM	1	24	22.87	1	0 ~ 1
			QPSK	12	6	22.47	1	0 ~ 1
			16QAM	12	6	21.76	2	0 ~ 2
			QPSK	25	0	22.45	1	0 ~ 1
			16QAM	25	0	21.80	2	0 ~ 2
784.5	23254		QPSK	1	0	23.95	0	0
			16QAM	1	0	22.88	1	0 ~ 1
			QPSK	1	24	23.61	0	0
			16QAM	1	24	22.97	1	0 ~ 1
			QPSK	12	6	22.69	1	0 ~ 1
			16QAM	12	6	21.89	2	0 ~ 2
			QPSK	25	0	22.49	1	0 ~ 1
			16QAM	25	0	21.93	2	0 ~ 2

Note: Small differences from expected MPR levels are a result of measurement uncertainty. Per the module manufacturer, the measured powers are typical, and are acceptable for use within the intended network infrastructure.

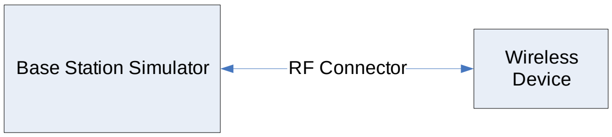

Figure 12-1
Power Measurement Setup

13 SAR TEST CONFIGURATIONS

13.1 SAR for Notebooks and Lap-touching Devices

Per KDB Publication 616217, Lap-touching devices that have transmitting antennas located less than 20 cm from the lap of the user require routine SAR evaluation. Such devices are considered portable and are capable of being held to the body. Devices are to be setup touching the phantom and are configured with maximum output power during SAR assessment for a worst-case SAR evaluation.

Figure 13-1
Notebook Setup for SAR

13.2 Threshold Distance Calculations per KDB Publication 447498

According to KDB 447498 and KDB 616217, all antennas within 5 cm of the user must be tested for stand-alone SAR. However, antennas with a larger separation distance to the user, must be evaluated depending on a threshold distance, and calculated using the output power and frequency of each mode. Therefore, any antenna with a separation distance less than the threshold distance must be tested for SAR. Figure 13-2 shows the antenna to antenna separation distances for the three transmitters. **Table 13-1** shows the calculations for the threshold distances for this device, per mode.

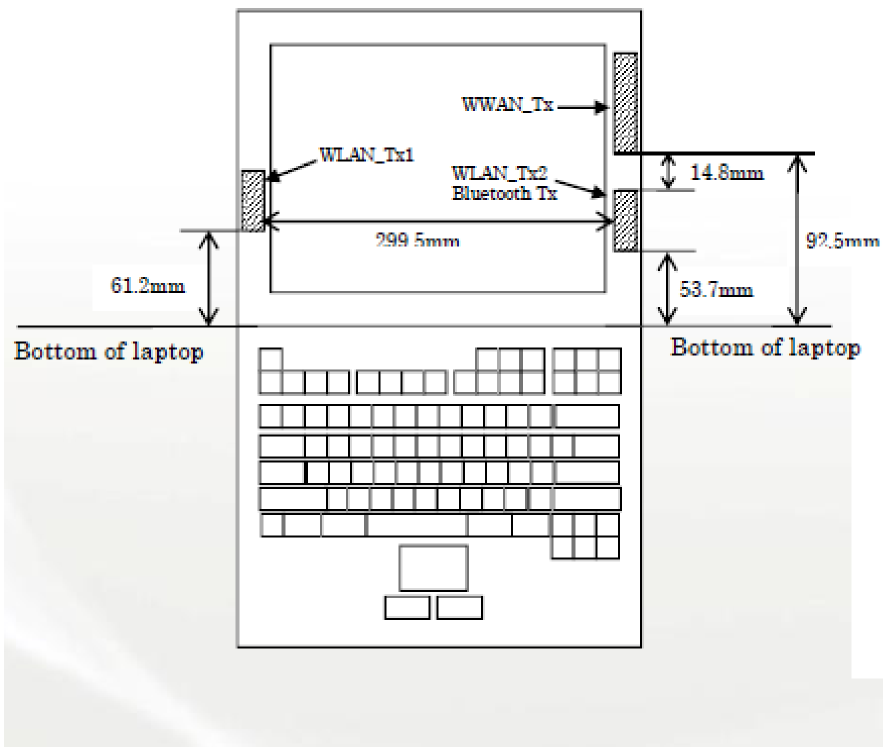

Figure 13-2
Antenna Diagram

Table 13-1
Stand-alone SAR Threshold Distances

Mode	Freq (GHz)	Power (mW)	60/f	n={P/(60/f)}-1	distance threshold (5+1/2n) (cm)	Tx Antenna	Antenna Distance to User (cm)	Stand-alone SAR Required?
GPRS850	0.835	1702.2	71.86	22.69	16	WWAN	9.25	**Yes**
EVDO850	0.835	327.34	71.86	3.56	7		9.25	No*
UMTS850	0.835	192.75	71.86	1.68	6		9.25	No*
LTE	0.782	251.19	76.73	2.27	6		9.25	No*
GPRS1900	1.88	1056.8	31.91	32.11	21		9.25	**Yes**
EVDO1900	1.88	299.92	31.91	8.40	9		9.25	No*
UMTS1900	1.9	188.36	31.58	4.96	7		9.25	No*
WIFI bgn	2.437	38	24.62	0.54	5	Tx Chain 1	6.12	No
						Tx Chain 2	5.37	No*
WIFI a	5.8	32	10.34	2.06	6	Tx Chain 1	6.12	No
						Tx Chain 2	5.37	**Yes**
	5.5	49	10.91	3.45	7	Tx Chain 1	6.12	**Yes**
						Tx Chain 2	5.37	**Yes**
	5.3	40	11.32	2.57	6	Tx Chain 1	6.12	No
						Tx Chain 2	5.37	**Yes**
	5.2	40	11.54	2.47	6	Tx Chain 1	6.12	No
						Tx Chain 2	5.37	**Yes**

* Required for SAR due to antenna-antenna separation distance. See Section 13.3.

The RF output power of Bluetooth was 3.802 mW, with is less than the threshold power (60/f). Therefore, SAR is not required for the Bluetooth transmitter.

5 GHz SAR is required for some configurations for both antennas. Therefore, all 5GHz bands were tested.

13.3 Simultaneous Transmission Requirements per KDB Publication 616217

It was determined from the antenna to antenna separation distance & power calculations that all modes for WWAN and WIFI Tx Chain 2 were additionally required for SAR. The following calculations in **Table 13-2** are examples of simultaneous SAR calculations that were considered to make this conclusion.

1. WIFI Tx Chain 1 is more than 5 cm from WIFI Tx Chain 2 and the WWAN Antenna and is therefore not required for simultaneous SAR evaluation.
2. EVDO 850, EVDO 1900, UMTS850, UMTS1900 and LTE were all evaluated at the highest output channel for simultaneous SAR requirements only.
3. Per April 2011 TCB Workshop Notes, since 2.4 GHz Wi-Fi and Bluetooth are implemented in the same chipset, using the same antenna and RF components, and the average and peak output power of Bluetooth is less than all WIFI modes, Bluetooth SAR is not required when 2.4 GHz WLAN is tested and below 0.4 W/kg.

Table 13-2
Antenna-Antenna Separation Distances (Select Calculations)

Antenna 1 (x)	Antenna 2 (y)	x	y	dxy, cm	nx	ny	Dxy, cm	Sim-Tx SAR (dxy<Dxy)
WWAN	WIFI Tx 2	EVDO850	WIFI a	1.48	3.56	2.06	8	**Yes**
WWAN	WIFI Tx 3	EVDO1900	WIFI a	1.48	8.40	2.06	10	**Yes**
WWAN	WIFI Tx 4	UMTS850	WIFI a	1.48	1.68	2.06	7	**Yes**
WWAN	WIFI Tx 7	UMTS1900	WIFI a	1.48	4.96	2.06	8	**Yes**
WWAN	WIFI Tx 8	LTE	WIFI bgn	1.48	2.27	0.54	6	**Yes**

1 = WWAN, 2= WIFI Tx 1, 3= WIFI Tx 2
$n_i=\{P_i/(60/f)\}-1$
d_{xy}= Distance between Antenna x and Antenna y
D_{xy}= Threshold Distance for Simultaneous Transmission

14 SAR DATA SUMMARY

Table 14-1
2G/3G Body SAR Results

MEASUREMENT RESULTS										
FREQUENCY		Mode	Service	Conducted Power [dBm]	Power Drift [dB]	Spacing	Serial Number	# of Slots	Side	SAR (1g)
MHz	Ch.									(W/kg)
836.60	190	GSM 850	GPRS	31.98	0.02	0.0 cm	DVT15590 1800003	2	lap	0.119
1880.00	661	GSM 1900	GPRS	29.34	-0.02	0.0 cm	DVT15590 1800003	2	lap	0.080
846.60	4233	UMTS V	RMC	22.85	0.06	0.0 cm	DVT15590 1800003	N/A	lap	0.064
1907.60	9538	UMTS II	RMC	22.75	0.09	0.0 cm	DVT15590 1800003	N/A	lap	0.081
824.70	1013	Cell. CDMA	EVDO-RTAP	25.15	-0.10	0.0 cm	DVT15590 1800004	N/A	lap	0.236
1851.25	25	PCS CDMA	EVDO-RTAP	24.77	-0.08	0.0 cm	DVT15590 1800004	N/A	lap	0.135
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population						Body 1.6 W/kg (mW/g) averaged over 1 gram				

Table 14-2
LTE Body SAR Results

MEASUREMENT RESULTS											
FREQUENCY	Mode	Modulation	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Spacing	Serial Number	Bandwidth [MHz]	# of RBs	RB Offset	SAR (1g)
MHz											(W/kg)
782	LTE	QPSK	22.63	0.04	1	0.0 cm	DVT 15590 1800003	10	25	12	0.045
782	LTE	QPSK	24.00	-0.07	0	0.0 cm	DVT 15590 1800003	10	1	0	0.064
782	LTE	QPSK	23.59	0.02	0	0.0 cm	DVT 15590 1800003	10	1	49	0.053
782	LTE	16 QAM	22.40	0.07	2	0.0 cm	DVT 15590 1800003	10	25	12	0.032
782	LTE	16 QAM	23.40	0.07	1	0.0 cm	DVT 15590 1800003	10	1	0	0.041
782	LTE	16 QAM	23.14	-0.06	1	0.0 cm	DVT 15590 1800003	10	1	49	0.038
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population						Body 1.6 W/kg (mW/g) averaged over 1 gram					

Table 14-3
2.4 GHz Body SAR Results

MEASUREMENT RESULTS												
FREQUENCY		Mode	Service	Conducted Power [dBm]	Power Drift [dB]	Spacing	Battery Type	Serial Number	Data Rate (Mbps)	Bandwidth [MHz]	Side	SAR (1g)
MHz	Ch.											(W/kg)
2437	6	802.11 b	DSSS	14.08	0.07	0.0 cm	Standard	DVT15590 1800006	1	20	Tx Chain 2	0.016
2437	6	802.11 g	DSSS	15.16	0.07	0.0 cm	Standard	DVT15590 1800006	6	20	Tx Chain 2	0.028
2437	6	802.11 n	DSSS	15.56	-0.07	0.0 cm	Standard	DVT15590 1800006	6.5	40	Tx Chain 2	0.033
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population						Body 1.6 W/kg (mW/g) averaged over 1 gram						

Table 14-4
5 GHz Body SAR Results

MEASUREMENT RESULTS											
FREQUENCY		Mode	Service	Conducted Power [dBm]	Power Drift [dB]	Spacing	Serial Number	Data Rate (Mbps)	Antenna	Position	SAR (1g)
MHz	Ch.										(W/kg)
5200	40	5.2 GHz WLAN	OFDM	14.83	0.10	0.0 cm	DVT15590 1800006	6	Tx1	Lap	**0.052**
5200	40	5.2 GHz WLAN	OFDM	15.92	0.07	0.0 cm	DVT15590 1800006	6	Tx2	Lap	0.028
5320	64	5.3 GHz WLAN	OFDM	15.01	0.07	0.0 cm	DVT15590 1800006	6	Tx1	Lap	0.025
5320	64	5.3 GHz WLAN	OFDM	16.06	0.07	0.0 cm	DVT15590 1800006	6	Tx2	Lap	**0.030**
5500	100	5.5 GHz WLAN	OFDM	15.40	0.02	0.0 cm	DVT15590 1800006	6	Tx1	Lap	**0.058**
5500	100	5.5 GHz WLAN	OFDM	16.81	0.07	0.0 cm	DVT15590 1800006	6	Tx2	Lap	0.056
5745	149	5.8 GHz WLAN	OFDM	13.73	0.08	0.0 cm	DVT15590 1800006	6	Tx1	Lap	**0.086**
5745	149	5.8 GHz WLAN	OFDM	14.90	0.08	0.0 cm	DVT15590 1800006	6	Tx2	Lap	0.080
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram				

SAR Test Notes:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration, with the laptop open at a 90 degree angle, at 0 cm from the flat SAM phantom according to KDB 447498 4) a) (see Section 13.1).
2. All modes of operation were investigated, and worst-case results are reported.
3. Tissue parameters and temperatures are listed on the SAR plots.
4. Batteries are fully charged for all readings.
5. Liquid tissue depth was at least 15.0 cm.
6. Justification for reduced test configurations: Per FCC/OET Bulletin 65 Supplement C (June 2001) and Public Notice DA-02-1438, if the SAR measured at the middle channel for each test configuration is at least 3.0 dB lower than the SAR limit, testing at the high and low channels is optional for such test configuration(s).
7. WCDMA mode in Body SAR was tested under RMC 12.2 kbps with HSPA Inactive. HSPA SAR tests were not required per KDB Publication 941225 because HSPA powers were not more than 0.25 dB higher than the RMC powers and RMC SAR was less than 1.2 W/kg.
8. CDMA2000 Body SAR was tested under EVDO Rev 0. Per FCC 3G Guidance (See Section 10.2.2). EVDO Rev. A was not required since the powers were not more than 0.25 dB than that of the EVDO Rev. 0 powers according to the FCC 3G Guidance.
9. Justification for reduced test configurations for GPRS/EDGE per KDB Publication 941225: The source-based time-averaged output power was evaluated for all multi-slot operations. The highest source based time-averaged powers (based on frame-averaged powers) were included in the evaluation. See Section 10.5.2.
10. GPRS SAR was tested with CS1 using GMSK modulation.
11. LTE SAR Test Considerations:
    a. Per KDB 941225 D05 Page 4, 3) A), QPSK with 50% RB is required.
    b. Per KDB 941225 D05 Page 4, 3) B), QPSK with 1 RB for both channel edges are required.
    c. Per KDB 941225 D05 Page 4, 4) A), 16QAM with 50% RB is required.
    d. Per KDB 941225 D05 Page 4, 4) B), 16QAM with 1RB for both channel edges are required.
    e. Per KDB 941225 D05 Page 5, 5) B), 5 MHz BW is not required to be tested for SAR since 5 MHz BW output powers are within ½ dB higher or lower, and also SAR is not > 1.45 W/kg.
    f. Per KDB 941225 S05 Page 4, A) I), 100% RB Allocation is not required to be tested since SAR is not > 1.45 W/kg.
    g. There is a permanently applied MPR implemented by the manufacturer. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1..
12. Justification for reduced test configurations for 2.4 GHz WIFI channels per KDB Publication 248227 and April 2010 FCC/TCB Meeting Notes: Highest average RF output power channel for the lowest data rate were selected for SAR evaluation. Higher data rates were not investigated since the average output powers were not greater than 0.25 dB that of the corresponding channel in the lowest data rate.
13. For 5 GHz, other IEEE 802.11 modes (including 40MHz BW and 802.11n) were not investigated since the average output powers were not greater than 0.25 dB than that of the corresponding channel in the lowest data rate IEEE 802.11a mode.
14. WLAN transmission was verified using a spectrum analyzer to confirm the SAR results observed.
15. To confirm the proper SAR liquid depth for 5 GHz Body tests, the z-axis plots from the system verification of the same liquid that was tested for 5 GHz body SAR tests were included to confirm the liquid depth, since the measured SAR was low.
16. EVDO 850, UMTS850, UMTS1900, EVDO1900 and LTE were required for simultaneous evaluation purposes only and were evaluated at the highest output channel.
17. Per KDB 447498 3) and 616217 Publication, 2.4 GHz WIFI for Tx Chain 1 was not required to be measured for SAR, based on output power and antenna-to-user and antenna-to-antenna separation distance calculations. See Section 13.
18. The measured SAR when extrapolated to the maximum tune-up power tolerance levels remain complaint for all operating configurations.

15 SIMULTANEOUS ANALYSIS

15.1 Simultaneous Transmission Calculations

It was concluded that SAR for all modes for the WWAN transmitter and WIFI Tx Chain 2 were required to be measured for simultaneous transmission purposes per KDB 616217. See Section 13.3.

Table 15-1
Simultaneous Transmission Analysis with WLAN Tx Chain 1 & 2 at 2.4 GHz

	Mode	2G/3G SAR (W/kg)	2.4 GHz WLAN Tx Chain 1 (W/kg)	2.4 GHz WLAN Tx Chain 2 (W/kg)	Σ SAR (W/kg)				SAR/Distance Ratio	Volumetric Simultaneous Transmissoin SAR (W/kg)
	Transmitter	1	2	3	1+2	1+3	2+3	1+2+3		
Body SAR	GPRS 850	0.119	0	0.033	**0.119**	**0.152**	**0.033**	**0.152**	N/A	N/A
	GPRS 1900	0.080	0	0.033	**0.080**	**0.113**	**0.033**	**0.113**	N/A	N/A
	UMTS V	0.064	0	0.033	**0.064**	**0.098**	**0.033**	**0.098**	N/A	N/A
	UMTS II	0.081	0	0.033	**0.081**	**0.114**	**0.033**	**0.114**	N/A	N/A
	Cell. CDMA	0.236	0	0.033	**0.236**	**0.269**	**0.033**	**0.269**	N/A	N/A
	PCS CDMA	0.135	0	0.033	**0.135**	**0.168**	**0.033**	**0.168**	N/A	N/A
	LTE	0.064	0	0.033	**0.064**	**0.097**	**0.033**	**0.097**	N/A	N/A

Per KDB 447498 3) and 616217 Publication, 2.4 GHz WLAN Tx Chain 1 was not required to be measured for SAR, based on output power and antenna-to-user and antenna-to-antenna separation distance calculations. See Section 13.

Table 15-2
Simultaneous Transmission Analysis with WLAN Tx Chain 1 & 2 at 5 GHz

	Mode	2G/3G SAR (W/kg)	5 GHz WLAN Tx Chain 1 (W/kg)	5 GHz WLAN Tx Chain 2 (W/kg)	Σ SAR (W/kg)				SAR/Distance Ratio	Volumetric Simultaneous Transmissoin SAR (W/kg)
	Transmitter	1	2a	3a	1+2a	1+3a	2a+3a	1+2a+3a		
Body SAR	GPRS 850	0.119	0.086	0.080	**0.205**	**0.199**	**0.166**	**0.285**	N/A	N/A
	GPRS 1900	0.080	0.086	0.080	**0.165**	**0.160**	**0.166**	**0.246**	N/A	N/A
	UMTS V	0.064	0.086	0.080	**0.150**	**0.145**	**0.166**	**0.230**	N/A	N/A
	UMTS II	0.081	0.086	0.080	**0.167**	**0.161**	**0.166**	**0.247**	N/A	N/A
	Cell. CDMA	0.236	0.086	0.080	**0.322**	**0.316**	**0.166**	**0.402**	N/A	N/A
	PCS CDMA	0.138	0.086	0.080	**0.224**	**0.218**	**0.166**	**0.304**	N/A	N/A
	LTE	0.064	0.086	0.080	**0.149**	**0.144**	**0.166**	**0.230**	N/A	N/A

Table 15-3
Simultaneous Transmission Analysis with WLAN Tx Chain 1 at 2.4 GHz & Tx Chain 2 at 5 GHz

	Mode	2G/3G SAR (W/kg)	2.4 GHz WLAN Tx Chain 1 (W/kg)	5 GHz WLAN Tx Chain 2 (W/kg)	Σ SAR (W/kg)				SAR/Distance Ratio	Volumetric Simultaneous Transmissoin SAR (W/kg)
Body SAR	Transmitter	1	2	3a	1+2	1+3a	2+3a	1+2+3a		
	GPRS 850	0.119	0	0.080	**0.119**	**0.199**	**0.080**	**0.199**	N/A	N/A
	GPRS 1900	0.080	0	0.080	**0.080**	**0.160**	**0.080**	**0.160**	N/A	N/A
	UMTS V	0.064	0	0.080	**0.064**	**0.145**	**0.080**	**0.145**	N/A	N/A
	UMTS II	0.081	0	0.080	**0.081**	**0.161**	**0.080**	**0.161**	N/A	N/A
	Cell. CDMA	0.236	0	0.080	**0.236**	**0.316**	**0.080**	**0.316**	N/A	N/A
	PCS CDMA	0.135	0	0.080	**0.135**	**0.215**	**0.080**	**0.215**	N/A	N/A
	LTE	0.064	0	0.080	**0.064**	**0.144**	**0.080**	**0.144**	N/A	N/A

Per KDB 447498 3) and 616217 Publication, 2.4 GHz WIFI for Tx Chain 1 was not required to be measured for SAR, based on output power and antenna-to-user and antenna-to-antenna separation distance calculations. See Section 13.

Table 15-4
Simultaneous Transmission Analysis with WLAN Tx Chain 1 at 5 GHz & Tx Chain 2 at 2.4 GHz

	Mode	2G/3G SAR (W/kg)	5 GHz WLAN Tx Chain 1 (W/kg)	2.4 GHz WLAN Tx Chain 2 (W/kg)	Σ SAR (W/kg)				SAR/Distance Ratio	Volumetric Simultaneous Transmissoin SAR (W/kg)
Body SAR	Transmitter	1	2a	3	1+2a	1+3	2a+3	1+2a+3		
	GPRS 850	0.119	0.086	0.033	**0.205**	**0.152**	**0.119**	**0.238**	N/A	N/A
	GPRS 1900	0.080	0.086	0.033	**0.165**	**0.113**	**0.119**	**0.199**	N/A	N/A
	UMTS V	0.064	0.086	0.033	**0.150**	**0.098**	**0.119**	**0.183**	N/A	N/A
	UMTS II	0.081	0.086	0.033	**0.167**	**0.114**	**0.119**	**0.200**	N/A	N/A
	Cell. CDMA	0.236	0.086	0.033	**0.322**	**0.269**	**0.119**	**0.355**	N/A	N/A
	PCS CDMA	0.138	0.086	0.033	**0.224**	**0.171**	**0.119**	**0.257**	N/A	N/A
	LTE	0.064	0.086	0.033	**0.149**	**0.097**	**0.119**	**0.183**	N/A	N/A

15.1 Simultaneous Transmission Conclusion

The above numerical summed SAR calculations show that all simultaneous transmissions are below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission scenarios will not exceed the SAR limit. Therefore, no additional volumetric SAR summation is required per FCC KDB Publication 648474.

16 SYSTEM VERIFICATION

16.1 Tissue Verification

Table 16-1
Measured Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	% dev σ	% dev ε
04/05/2011	750B	740	0.928	53.53	0.96	55.73	-3.43%	-3.95%
		755	0.933	53.30	0.96	55.65	-3.12%	-4.22%
		770	0.942	53.21	0.96	55.56	-2.28%	-4.24%
		785	0.954	52.93	0.97	55.48	-1.14%	-4.60%
		800	0.974	52.76	0.97	55.40	0.72%	-4.76%
04/04/2011	835B	820	0.929	53.64	0.97	55.28	-4.13%	-2.97%
		835	0.944	53.84	0.97	55.20	-2.68%	-2.46%
		850	0.971	53.63	0.99	55.15	-1.72%	-2.76%
04/08/2011	835B	820	1.010	54.94	0.97	55.28	4.23%	-0.62%
		835	1.015	54.90	0.97	55.20	4.64%	-0.54%
		850	1.030	54.48	0.99	55.15	4.25%	-1.22%
03/22/2011	1900B	1850	1.500	50.99	1.52	53.30	-1.32%	-4.33%
		1880	1.542	50.93	1.52	53.30	1.45%	-4.45%
		1910	1.569	50.77	1.52	53.30	3.22%	-4.75%
03/29/2011	1900B	1850	1.508	51.20	1.52	53.30	-0.79%	-3.94%
		1880	1.545	51.10	1.52	53.30	1.64%	-4.13%
		1910	1.580	50.97	1.52	53.30	3.95%	-4.37%
04/06/2011	1900B	1850	1.552	52.06	1.52	53.30	2.11%	-2.33%
		1880	1.573	52.04	1.52	53.30	3.49%	-2.36%
		1910	1.584	51.81	1.52	53.30	4.21%	-2.80%
04/06/2011	2450B	2401	1.978	50.93	1.90	52.77	3.94%	-3.48%
		2450	2.036	50.76	1.95	52.70	4.41%	-3.68%
		2499	2.103	50.58	2.02	52.64	4.16%	-3.91%
04/05/2011	5200B-5800B	5170	5.393	47.29	5.26	49.06	2.45%	-3.60%
		5210	5.452	47.04	5.31	49.00	2.65%	-4.00%
		5250	5.512	46.97	5.36	48.95	2.87%	-4.04%
		5270	5.540	47.05	5.38	48.92	2.95%	-3.82%
		5310	5.604	46.91	5.43	48.87	3.24%	-4.00%
		5350	5.650	46.84	5.47	48.81	3.29%	-4.04%
		5470	5.851	46.58	5.62	48.65	4.20%	-4.25%
		5510	5.870	46.56	5.66	48.59	3.69%	-4.19%
		5550	5.942	46.49	5.71	48.54	4.10%	-4.22%
		5570	5.978	46.33	5.73	48.51	4.31%	-4.50%
		5610	6.039	46.36	5.78	48.46	4.52%	-4.33%
		5650	6.111	46.26	5.83	48.40	4.91%	-4.43%
		5670	6.098	46.17	5.85	48.38	4.27%	-4.56%
		5710	6.161	46.09	5.90	48.32	4.51%	-4.62%
		5750	6.235	46.09	5.94	48.27	4.93%	-4.51%
		5770	6.258	46.03	5.97	48.24	4.91%	-4.58%
		5810	6.284	45.95	6.01	48.19	4.52%	-4.64%
		5850	6.330	45.85	6.06	48.13	4.49%	-4.74%

Note: KDB Publication 450824 was ensured to be applied for probe calibration frequencies greater than or equal to 50 MHz of the DUT frequencies.

The above measured tissue parameters were used in the DASY software to perform interpolation via the DASY software to determine actual dielectric parameters at the test frequencies (per IEEE 1528 6.6.1.2). The SAR test plots may slightly differ from the table above since the DASY software rounds to three significant digits.

16.2 Measurement Procedure for Tissue verification

1) The network analyzer and probe system was configured and calibrated.
2) The probe was immersed in the sample which was placed in a nonmetallic container. Trapped air bubbles beneath the flange were minimized by placing the probe at a slight angle.
3) The complex admittance with respect to the probe aperture was measured
4) The complex relative permittivity , for example from the below equation (Pournaropoulos and Misra):

$$Y = \frac{j2\omega\varepsilon_r\varepsilon_0}{\left[\ln(b/a)\right]^2}\int_a^b\int_a^b\int_0^\pi \cos\phi' \frac{\exp\left[-j\omega r(\mu_0\varepsilon_r^{'}\varepsilon_0)^{1/2}\right]}{r} d\phi' d\rho' d\rho$$

where *Y* is the admittance of the probe in contact with the sample, the primed and unprimed coordinates refer to source and observation points, respectively, $r^2 = \rho^2 + \rho'^2 - 2\rho\rho'\cos\phi'$, ω is the angular frequency, and $j = \sqrt{-1}$.

16.3 Justification for Extended SAR Dipole Calibrations

Usage of SAR dipoles calibrated less than 2 years ago but more than 1 year ago were confirmed in maintaining return loss (< - 20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB Publication 450824:

D835V2 SN: 4d026								
	Head				**Body**			
Date of Measurement	Return Loss (dB)	**Δ %**	Impedance (Ω)	**ΔΩ**	Return Loss (dB)	**Δ %**	Impedance (Ω)	**ΔΩ**
8/24/2009	-22.5		51		-20.6		46.9	
3/2/2011	-22.7	0.9%	50.1	-0.9	-20.9	1.5%	48	1.1

D2450V2 SN: 719								
	Head				**Body**			
Date of Measurement	Return Loss (dB)	**Δ %**	Impedance (Ω)	**ΔΩ**	Return Loss (dB)	**Δ %**	Impedance (Ω)	**ΔΩ**
8/27/2009	-28.6		53.4		-27.2		48.2	**0.0**
3/2/2011	-28.6	**0.0%**	52	**-1.4**	-27.4	**0.7%**	49.9	**1.7**

16.4 Test System Verification

Prior to assessment, the system is verified to ±10% of the manufacturer SAR measurement on the reference dipole at the time of calibration.

Table 16-2
System Verification Results

System Verification TARGET & MEASURED										
Date:	**Amb. Temp (°C)**	**Liquid Temp (°C)**	**Input Power (W)**	**Tissue Frequency (MHz)**	**Dipole SN**	**Tissue Type**	**Measured SAR_{1g} (W/kg)**	**1 W Target SAR_{1g} (W/kg)**	**1 W Normalized SAR_{1g} (W/kg)**	**Deviation (%)**
04/05/2011	24.7	22.9	0.250	750	1003	Body	2.1	8.850	8.400	-5.08%
04/04/2011	23.9	22.0	0.063	835	4d047	Body	0.615	9.850	9.762	-0.89%
04/08/2011	24.3	22.5	0.100	835	4d026	Body	1.02	9.780	10.200	4.29%
03/22/2011	24.1	22.7	0.040	1900	502	Body	1.75	41.100	43.750	6.45%
03/29/2011	24.2	22.7	0.040	1900	502	Body	1.69	41.100	42.250	2.80%
04/06/2011	23.7	21.9	0.040	1900	502	Body	1.7	41.100	42.500	3.41%
04/06/2011	24.2	22.6	0.025	2450	719	Body	1.34	51.400	53.600	4.28%
04/05/2011	24.3	22.7	0.025	5200	1057	Body	2	77.700	80.000	2.96%
04/05/2011	24.5	22.8	0.025	5500	1057	Body	2.03	84.400	81.200	-3.79%
04/05/2011	24.6	22.9	0.025	5800	1057	Body	1.93	75.000	77.200	2.93%

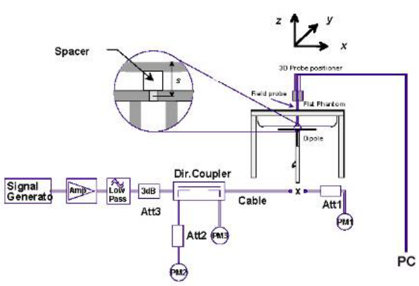

Figure 16-1
System Verification Setup Diagram

Figure 16-2
System Verification Setup Photo

17 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	85070B	Dielectric Probe Kit	8/22/2010	Annual	8/22/2011	US33020316
Agilent	8648D	(9kHz-4GHz) Signal Generator	10/13/2010	Annual	10/13/2011	3613A00315
Agilent	E5515C	Wireless Communications Test Set	10/11/2010	Annual	10/11/2011	GB46110872
Agilent	E5515C	Wireless Communications Test Set	10/8/2010	Annual	10/8/2011	GB46310798
Agilent	E5515C	Wireless Communications Test Set	8/13/2010	Annual	8/13/2011	GB41450275
Gigatronics	80701A	(0.05-18GHz) Power Sensor	10/11/2010	Annual	10/11/2011	1833460
Gigatronics	8651A	Universal Power Meter	10/11/2010	Annual	10/11/2011	8650319
Index SAR	IXTL-010	Dielectric Measurement Kit	N/A		N/A	N/A
Index SAR	IXTL-030	30MM TEM line for 6 GHz	N/A		N/A	N/A
Pasternack	PE2208-6	Bidirectional Coupler	N/A		N/A	N/A
Pasternack	PE2209-10	Bidirectional Coupler	N/A		N/A	N/A
Rohde & Schwarz	CMU200	Base Station Simulator	11/11/2010	Annual	11/11/2011	836371/0079
Rohde & Schwarz	CMU200	Base Station Simulator	6/21/2010	Annual	6/21/2011	833855/0010
SPEAG	D1450V2	1450 MHz SAR Dipole	5/20/2009	Biennial	5/20/2011	1025
SPEAG	D1765V2	1765 MHz SAR Dipole	5/19/2009	Biennial	5/19/2011	1008
SPEAG	D1900V2	1900 MHz SAR Dipole	2/17/2011	Annual	2/17/2012	502
SPEAG	D1900V2	1900 MHz SAR Dipole	8/18/2009	Biennial	8/18/2011	5d080
SPEAG	D2450V2	2450 MHz SAR Dipole	8/27/2009	Biennial	8/27/2011	719
SPEAG	D2450V2	2450 MHz SAR Dipole	2/8/2011	Annual	2/8/2012	797
SPEAG	D2600V2	2600 MHz SAR Dipole	8/12/2009	Biennial	8/12/2011	1004
SPEAG	D5GHzV2	5 GHz SAR Dipole	8/19/2009	Biennial	8/19/2011	1007
SPEAG	D5GHzV2	5 GHz SAR Dipole	2/11/2011	Annual	2/11/2012	1057
SPEAG	D835V2	835 MHz SAR Dipole	2/9/2011	Annual	2/9/2012	4d047
SPEAG	D835V2	835 MHz SAR Dipole	8/24/2009	Biennial	8/24/2011	4d026
SPEAG	DAE3	Dasy Data Acquisition Electronics	11/18/2010	Annual	11/18/2011	455
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/17/2011	Annual	3/17/2012	704
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/21/2010	Annual	4/21/2011	665
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/21/2011	Annual	2/21/2012	649
SPEAG	ES3DV2	SAR Probe	9/21/2010	Annual	9/21/2011	3022
SPEAG	EX3DV4	SAR Probe	8/19/2010	Annual	8/19/2011	3561
SPEAG	EX3DV4	SAR Probe	2/14/2011	Annual	2/14/2012	3550
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/8/2010	Annual	7/8/2011	859
SPEAG	D750V3	750 MHz Dipole	2/14/2011	Annual	2/14/2012	1003
SPEAG	ES3DV3	SAR Probe	3/24/2011	Annual	3/24/2012	3213
SPEAG	ES3DV3	SAR Probe	4/20/2010	Annual	4/20/2011	3209
SPEAG	D1640V2	1640 MHz Dipole	8/17/2010	Biennial	8/17/2012	321
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	8/30/2010	Annual	8/30/2011	100976
Anritsu	MA2481A	Power Sensor	2/7/2011	Annual	2/7/2012	5318
Anritsu	MA2481A	Power Sensor	2/7/2011	Annual	2/7/2012	5442
Anritsu	ML2438A	Power Meter	2/7/2011	Annual	2/7/2012	1190013
Anritsu	ML2438A	Power Meter	2/7/2011	Annual	2/7/2012	98150041
Anritsu	ML2438A	Power Meter	2/7/2011	Annual	2/7/2012	1070030
Anritsu	MA2481A	Power Sensor	2/7/2011	Annual	2/7/2012	5821
Anritsu	MA2481A	Power Sensor	2/7/2011	Annual	2/7/2012	8013
Anritsu	MA2481A	Power Sensor	2/7/2011	Annual	2/7/2012	2400
Aprel	ALS-PR-DIEL	Dielectric Probe Kit	N/A		N/A	260-00959
Agilent	E5515C	Wireless Communications Test Set	8/13/2010	Annual	8/13/2011	GB43304447
Amplifier Research	5S1G4	5W, 800MHz-4.2GHz	N/A			17042
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	N/A			N/A
Agilent	E5515C	Wireless Communications Test Set	2/8/2011	Annual	2/8/2012	GB45360985
Speag	D3700V2	3700 MHz SAR Dipole	2/16/2011	Annual	2/16/2012	1002
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	3/11/2011	Annual	3/11/2012	103962
Control Company	61220-416	Long-Stem Thermometer	2/15/2011	Biennial	2/15/2013	111331322
Control Company	61220-416	Long-Stem Thermometer	2/15/2011	Biennial	2/15/2013	111331323
Control Company	61220-416	Long-Stem Thermometer	2/15/2011	Biennial	2/15/2013	111331330
Control Company	61220-416	Long-Stem Thermometer	2/15/2011	Biennial	2/15/2013	111331332
Control Company	61220-416	Long-Stem Thermometer	3/16/2011	Biennial	3/16/2013	111391601
Speag	D2600V2	2600 MHz SAR Dipole	N/A			1027

Justification for 2-year calibration cycle for SAR dipoles is found in Section 16.3.

18 MEASUREMENT UNCERTAINTIES

Applicable for 750 – 3000 MHz.

a	b	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	IEEE 1528 Sec.	Tol. (± %)	Prob. Dist.	Div.	c_i 1gm	c_i 10 gms	1gm u_i (± %)	10gms u_i (± %)	v_i
Measurement System									
Probe Calibration	E.2.1	5.5	N	1	1.0	1.0	5.5	5.5	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	1.0	1.0	1.3	1.3	∞
Boundary Effect	E.2.3	0.4	N	1	1.0	1.0	0.4	0.4	∞
Linearity	E.2.4	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	E.2.5	5.1	N	1	1.0	1.0	5.1	5.1	∞
Readout Electronics	E.2.6	1.0	N	1	1.0	1.0	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	E.6.3	2.9	R	1.73	1.0	1.0	1.7	1.7	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	1.0	R	1.73	1.0	1.0	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	6.0	N	1	1.0	1.0	6.0	6.0	287
Device Holder Uncertainty	E.4.1	3.32	R	1.73	1.0	1.0	1.9	1.9	∞
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	3.8	N	1	0.64	0.43	2.4	1.6	6
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Liquid Permittivity - measurement uncertainty	E.3.3	4.5	N	1	0.60	0.49	2.7	2.2	6
Combined Standard Uncertainty (k=1)			RSS				11.8	11.5	299
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				23.7	23.0	

The above measurement uncertainties are according to IEEE Std. 1528-2003

Applicable for 5 GHz.

a	b	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	IEEE 1528 Sec.	Tol. (± %)	Prob. Dist.	Div.	c_i 1gm	c_i 10 gms	1gm u_i (± %)	10gms u_i (± %)	v_i
Measurement System									
Probe Calibration	E.2.1	6.6	N	1	1.0	1.0	6.6	6.6	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	1.0	1.0	1.3	1.3	∞
Boundary Effect	E.2.3	0.4	N	1	1.0	1.0	0.4	0.4	∞
Linearity	E.2.4	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	E.2.5	5.1	N	1	1.0	1.0	5.1	5.1	∞
Readout Electronics	E.2.6	1.0	N	1	1.0	1.0	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	E.6.3	2.9	R	1.73	1.0	1.0	1.7	1.7	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	1.0	R	1.73	1.0	1.0	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	6.0	N	1	1.0	1.0	6.0	6.0	287
Device Holder Uncertainty	E.4.1	3.32	R	1.73	1.0	1.0	1.9	1.9	∞
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	3.8	N	1	0.64	0.43	2.4	1.6	6
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Liquid Permittivity - measurement uncertainty	E.3.3	4.5	N	1	0.60	0.49	2.7	2.2	6
Combined Standard Uncertainty (k=1)			RSS				12.4	12.0	299
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				24.7	24.0	

The above measurement uncertainties are according to IEEE Std. 1528-2003

19 CONCLUSION

19.1 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC and Industry Canada, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables. [3]

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APPENDIX A: SAR TEST DATA

PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG-41312L; Type: Laptop PC with WWAN, WLAN, LTE and Bluetooth
Serial: DVT15590 1800003

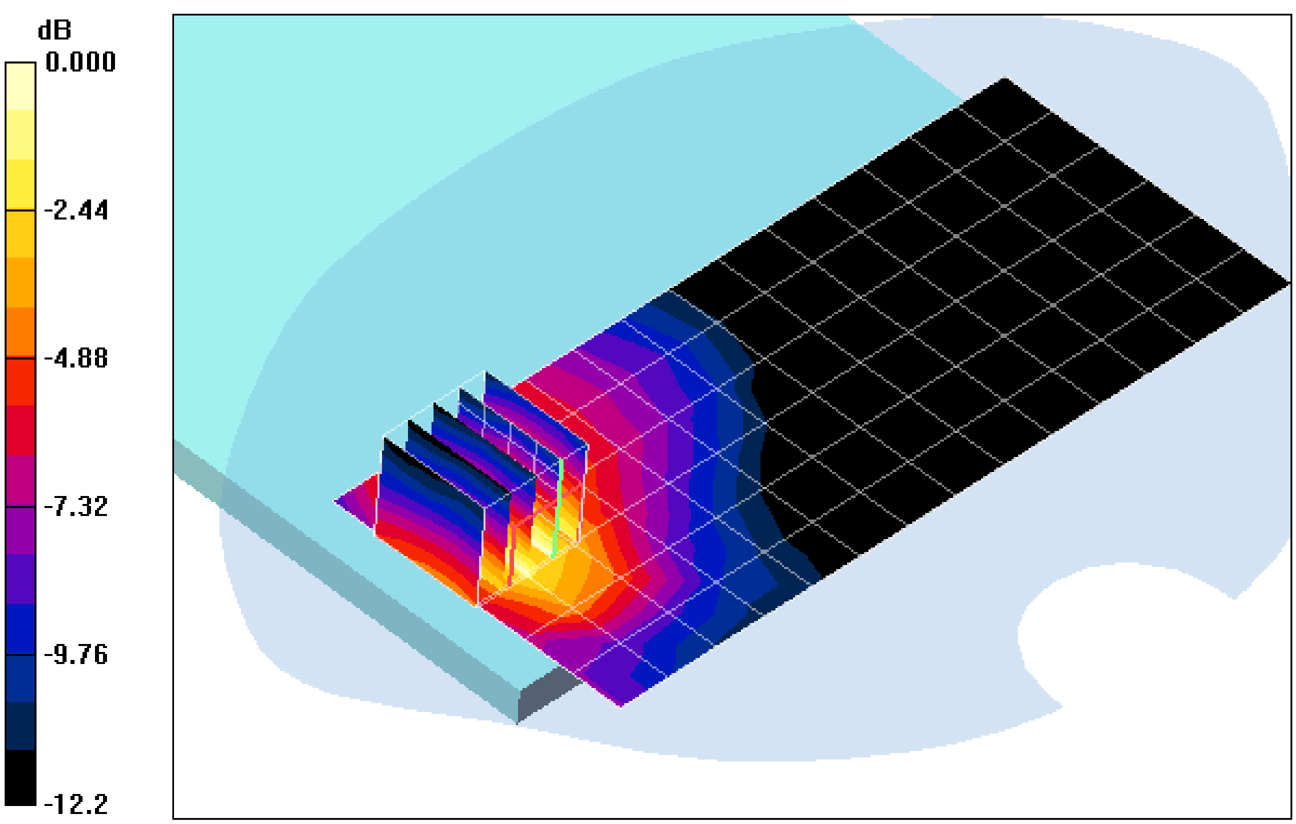
Communication System: LTE RF; Frequency: 782 MHz;Duty Cycle: 1:1
Medium: 785 Body Medium parameters used (interpolated):
f = 782 MHz; σ = 0.952 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-05-2011; Ambient Temp: 24.7°C; Tissue Temp: 22.9°C

Probe: ES3DV2 - SN3022; ConvF(6.09, 6.09, 6.09); Calibrated: 9/21/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn704; Calibrated: 3/17/2011
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: LTE, Body SAR, Back side, Mid.ch, QPSK, 1 RB, RB Offset 0

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.34 V/m
Peak SAR (extrapolated) = 0.110 W/kg
SAR(1 g) = 0.064 mW/g; SAR(10 g) = 0.040 mW/g



0 dB = 0.069mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG-41312L; Type: Laptop PC with WWAN, WLAN, LTE and Bluetooth
Serial: DVT15590 1800003

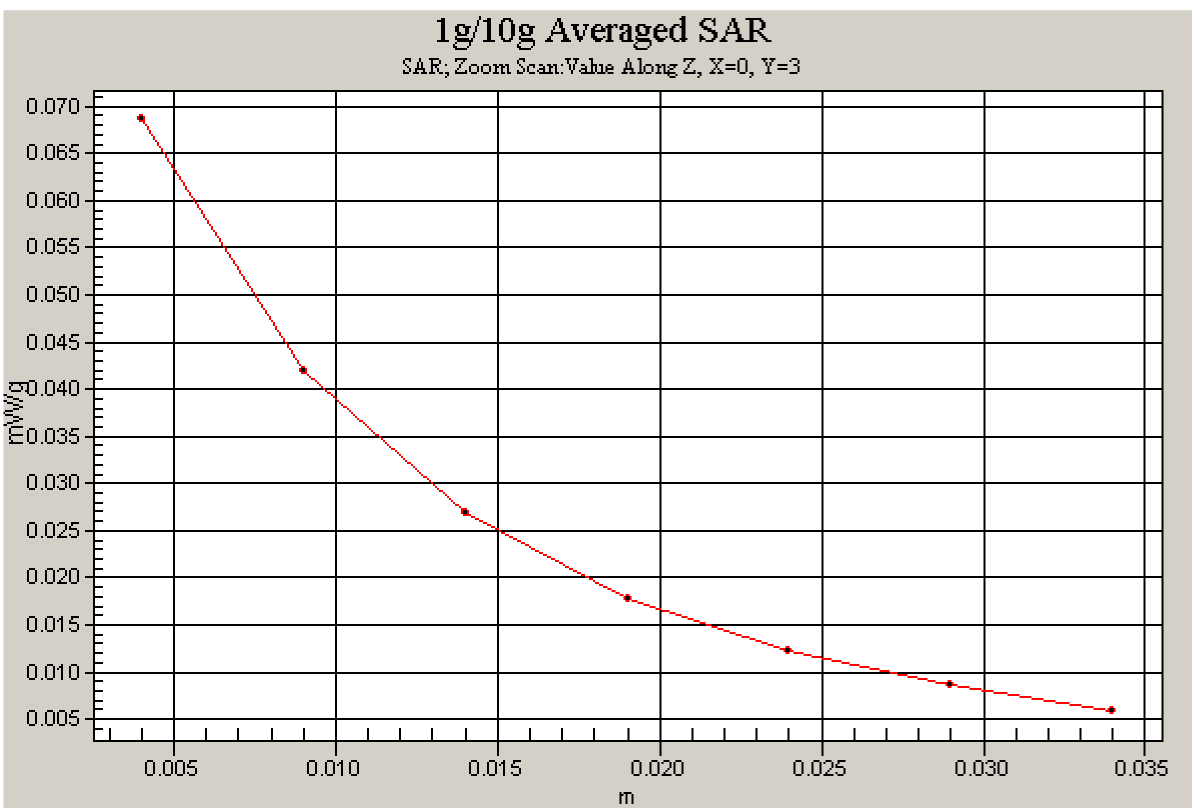
Communication System: LTE RF; Frequency: 782 MHz;Duty Cycle: 1:1
Medium: 785 Body Medium parameters used (interpolated):
f = 782 MHz; σ = 0.952 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-05-2011; Ambient Temp: 24.7°C; Tissue Temp: 22.9°C

Probe: ES3DV2 - SN3022; ConvF(6.09, 6.09, 6.09); Calibrated: 9/21/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn704; Calibrated: 3/17/2011
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: LTE, Body SAR, Back side, Mid.ch, QPSK, 1 RB, RB Offset 0

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.34 V/m
Peak SAR (extrapolated) = 0.110 W/kg
SAR(1 g) = 0.064 mW/g; SAR(10 g) = 0.040 mW/g



PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG-41312L; Type: Laptop PC with WWAN, WLAN, LTE and Bluetooth
Serial: DVT15590 1800003

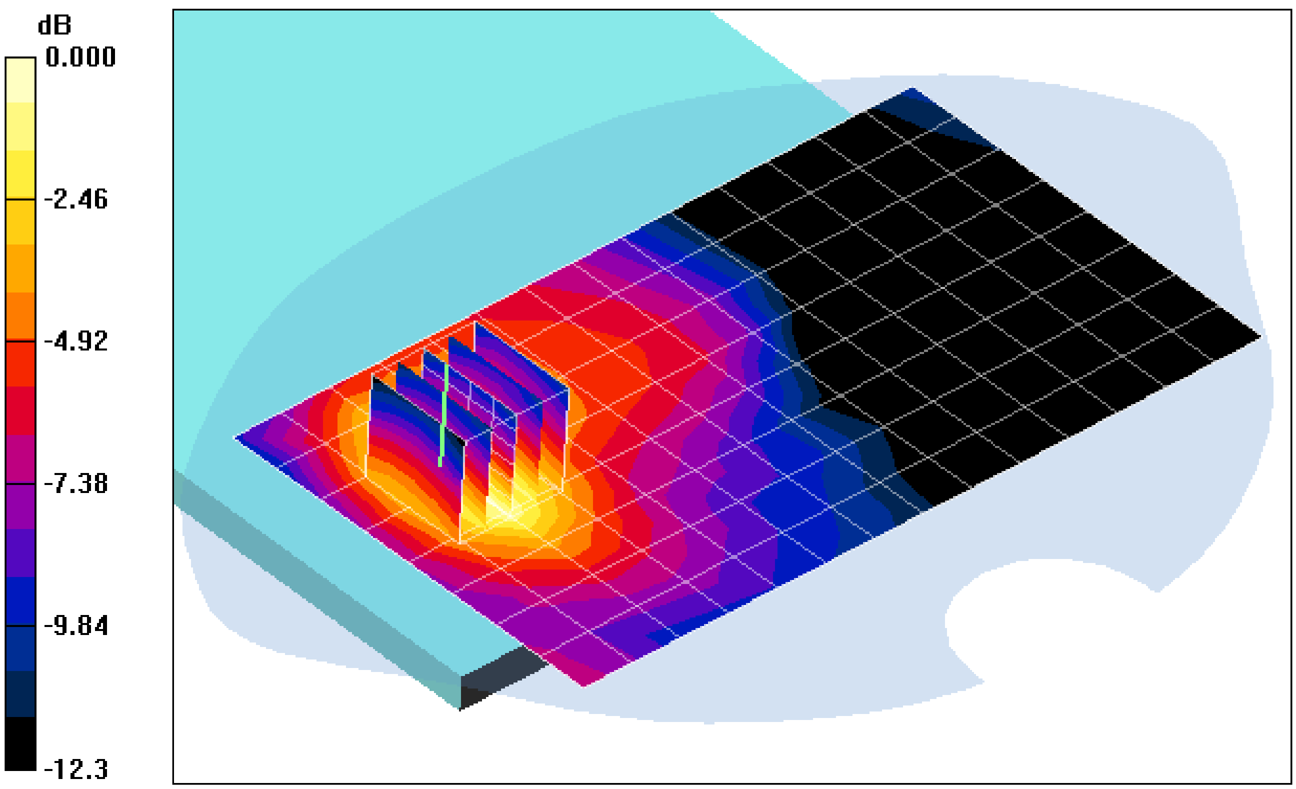
Communication System: GSM850 GPRS; 2 Tx slots; Frequency: 836.6 MHz;Duty Cycle: 1:4.15
Medium: 835 Body Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.947 mho/m; ε_r = 53.8; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-04-2011; Ambient Temp: 23.9°C; Tissue Temp: 22.0 °C

Probe: EX3DV4 - SN3561; ConvF(8.09, 8.09, 8.09); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: GPRS 850, Body SAR, Back side, Mid.ch, 2 Tx Slots

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.4 V/m
Peak SAR (extrapolated) = 0.191 W/kg
SAR(1 g) = 0.119 mW/g; SAR(10 g) = 0.076 mW/g



0 dB = 0.131mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG-41312L; Type: Laptop PC with WWAN, WLAN, LTE and Bluetooth
Serial: DVT15590 1800003

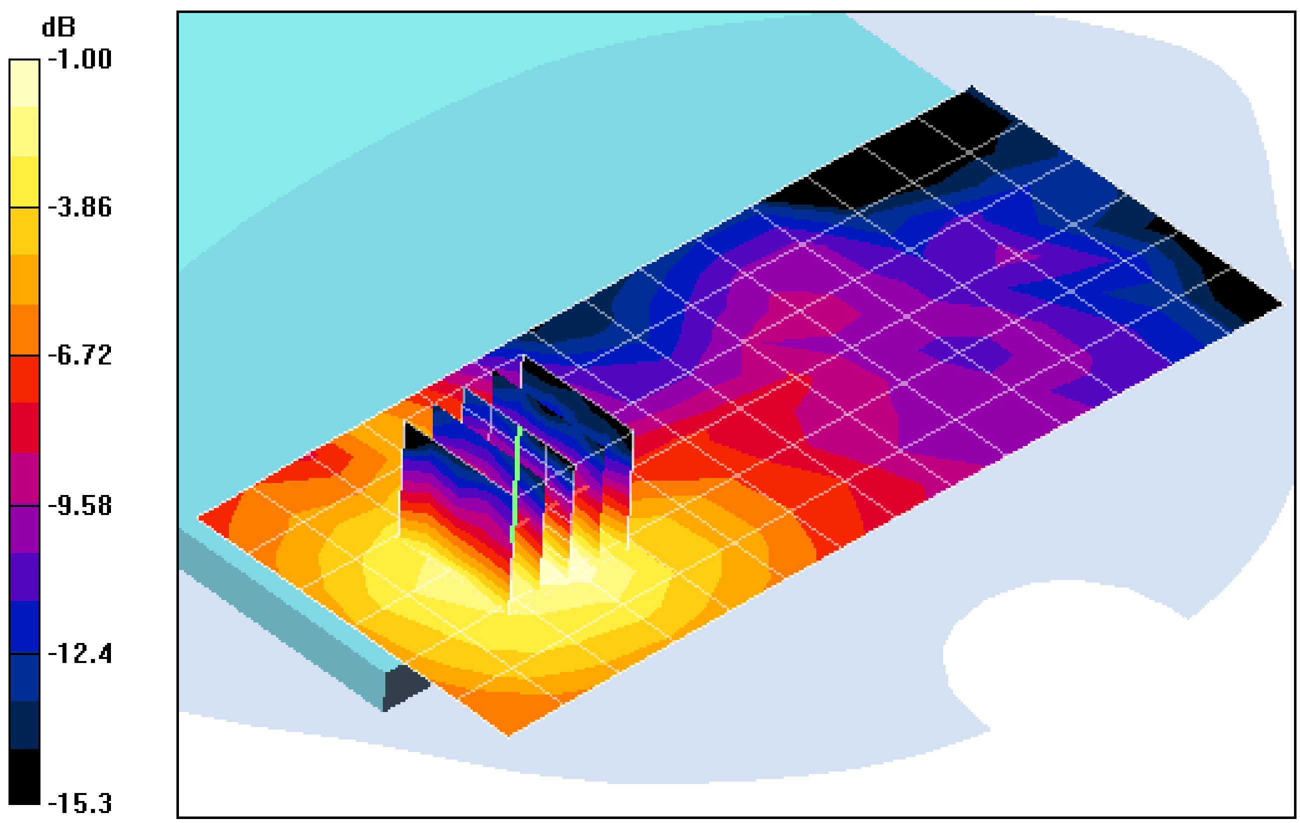
Communication System: GSM1900 GPRS; 2 Tx slots; Frequency: 1880 MHz;Duty Cycle: 1:4.15
Medium: 1900 Body Medium parameters used:
$f = 1880$ MHz; $\sigma = 1.54$ mho/m; $\varepsilon_r = 51.1$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 0.0. cm

Test Date: 03-29-2011; Ambient Temp: 24.2 ° C; Tissue Temp: 22.7 ° C

Probe: EX3DV4 - SN3550; ConvF(6.77, 6.77, 6.77); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: GPRS 1900, Body SAR, Laptop Position, Mid.ch, 2 Tx Slots

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.39 V/m
Peak SAR (extrapolated) = 0.132 W/kg
SAR(1 g) = 0.080 mW/g; SAR(10 g) = 0.044 mW/g



0 dB = 0.094mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG-41312L; Type: Laptop PC with WWAN, WLAN, LTE and Bluetooth
Serial: DVT15590 1800003

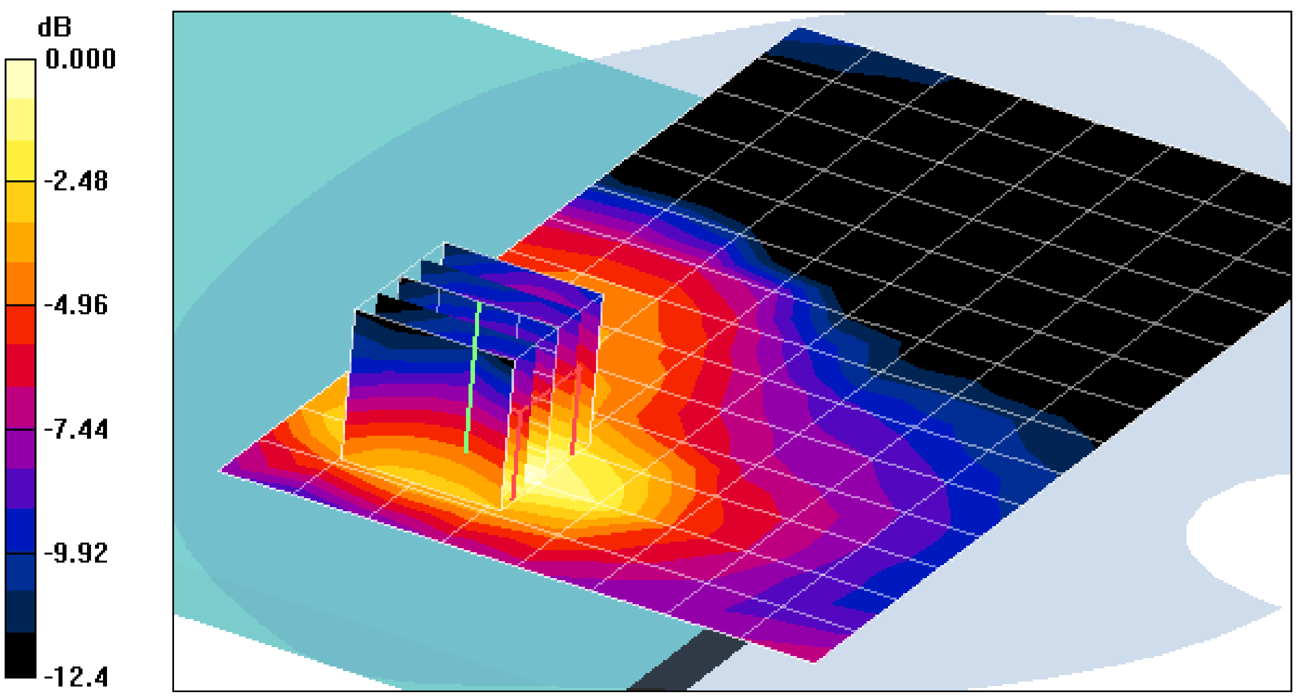
Communication System: WCDMA850; Frequency: 846.6 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 846.6 MHz; σ = 0.965 mho/m; ε_r = 53.7; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-04-2011; Ambient Temp: 23.9°C; Tissue Temp: 22.0 °C

Probe: EX3DV4 - SN3561; ConvF(8.09, 8.09, 8.09); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WCDMA 850, Body SAR, Back side, High ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.29 V/m
Peak SAR (extrapolated) = 0.103 W/kg
SAR(1 g) = 0.064 mW/g; SAR(10 g) = 0.041 mW/g



0 dB = 0.071mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG-41312L; Type: Laptop PC with WWAN, WLAN, LTE and Bluetooth
Serial: DVT15590 1800003

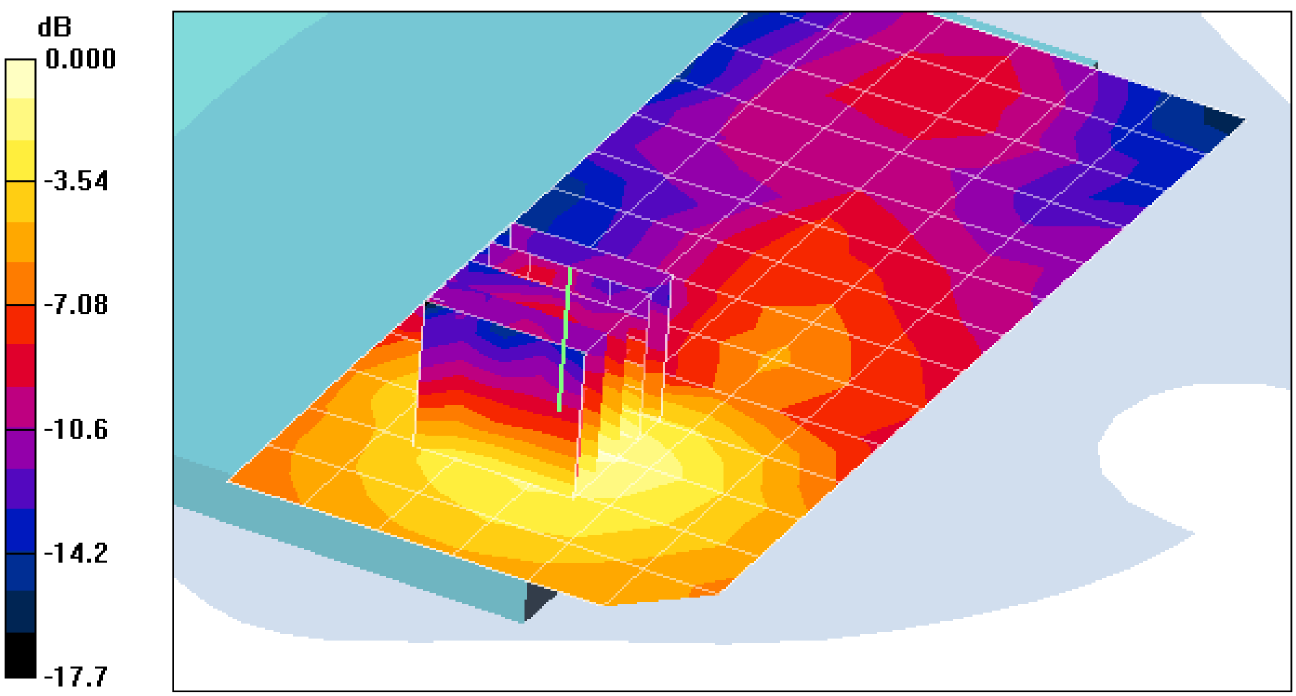
Communication System: WCDMA1900; Frequency: 1907.6 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1907.6 MHz; σ = 1.58 mho/m; ε_r = 51; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 03-29-2011; Ambient Temp: 24.2°C; Tissue Temp: 22.7°C

Probe: EX3DV4 - SN3550; ConvF(6.77, 6.77, 6.77); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WCDMA 1900, Body SAR, Laptop Position, High.ch

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.86 V/m
Peak SAR (extrapolated) = 0.136 W/kg
SAR(1 g) = 0.081 mW/g; SAR(10 g) = 0.045 mW/g



0 dB = 0.087mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG-41312L; Type: Laptop PC with WWAN, WLAN, LTE and Bluetooth
Serial: DVT15590 1800004

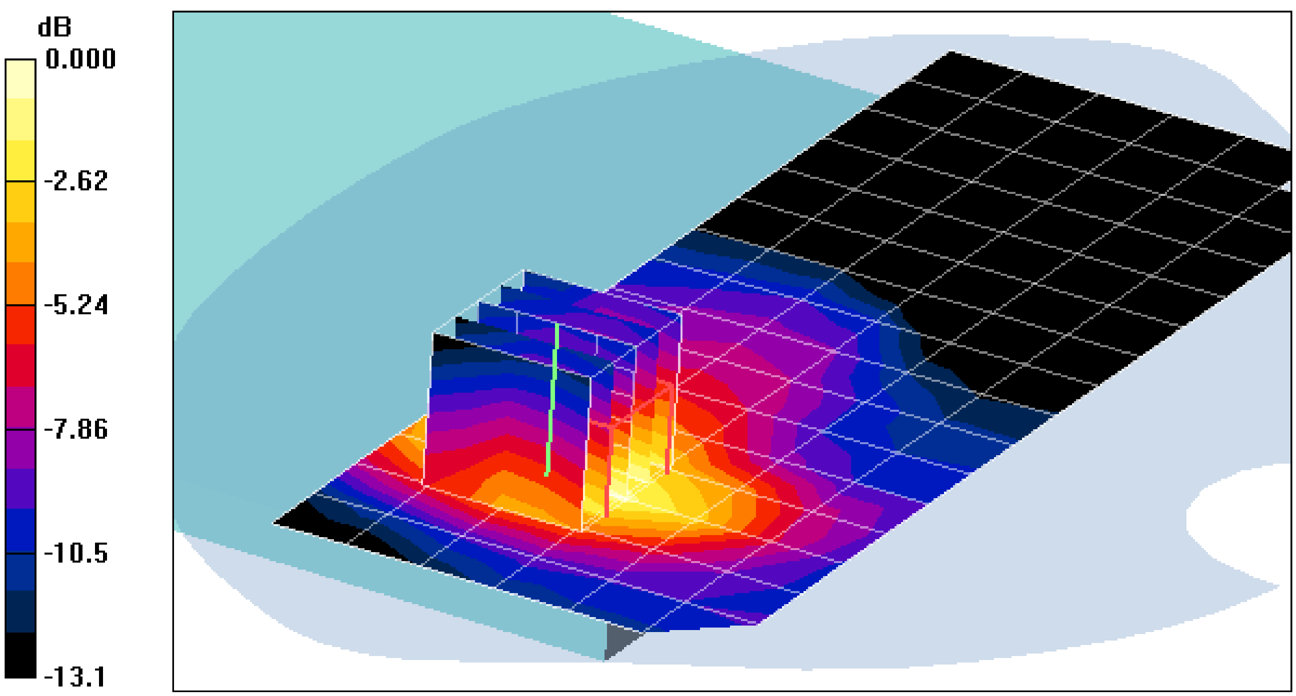
Communication System: Cellular CDMA; Frequency: 824.7 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 824.7 MHz; σ = 1.01 mho/m; ε_r = 54.9; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.00 cm

Test Date: 04-08-2011; Ambient Temp: 24.3 ° C; Tissue Temp: 22.5 ° C

Probe: EX3DV4 - SN3550; ConvF(8.11, 8.11, 8.11); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: Cellular CDMA EVDO RTAP, Body SAR, Laptop, Low ch

Area Scan (7x17x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.1 V/m
Peak SAR (extrapolated) = 0.411 W/kg
SAR(1 g) = 0.236 mW/g; SAR(10 g) = 0.141 mW/g



0 dB = 0.249mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG-41312L; Type: Laptop PC with WWAN, WLAN, LTE and Bluetooth
Serial: DVT15590 1800004

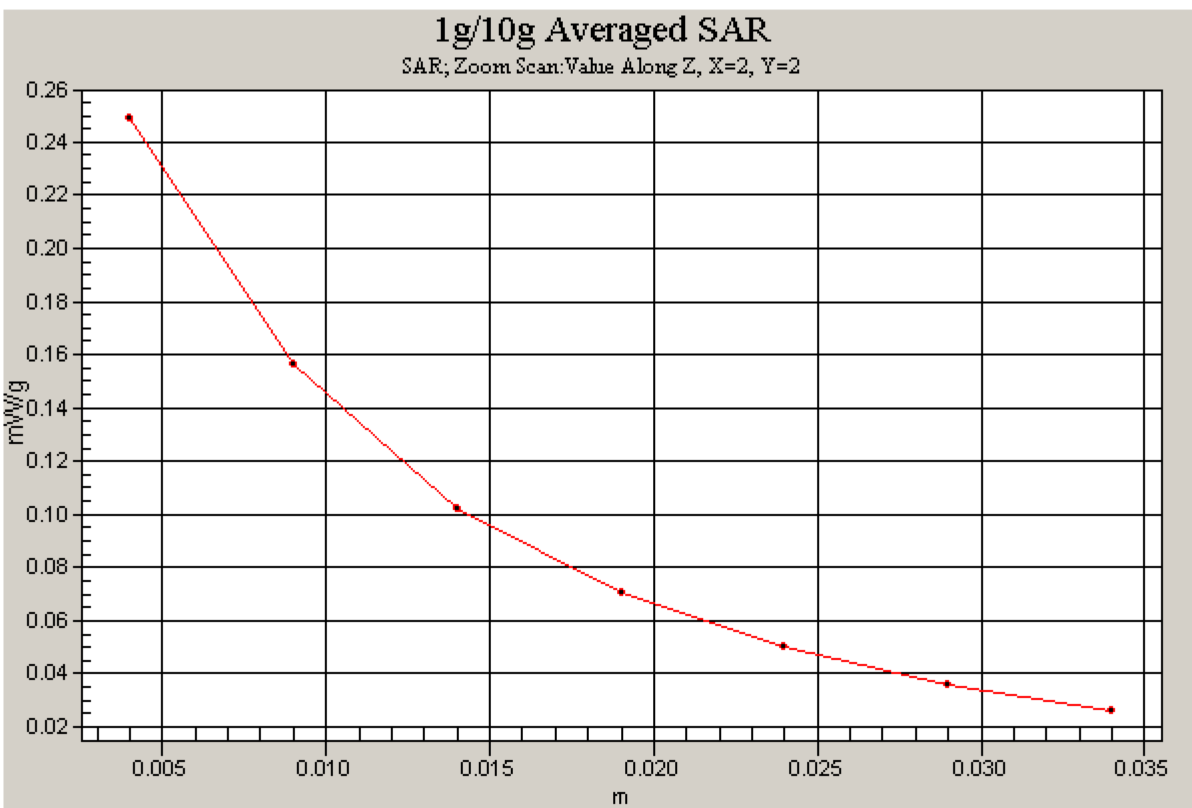
Communication System: Cellular CDMA; Frequency: 824.7 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 824.7 MHz; σ = 1.01 mho/m; ε_r = 54.9; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.00 cm

Test Date: 04-08-2011; Ambient Temp: 24.3 ° C; Tissue Temp: 22.5 ° C

Probe: EX3DV4 - SN3550; ConvF(8.11, 8.11, 8.11); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: Cellular CDMA EVDO RTAP, Body SAR, Laptop, Low ch

Area Scan (7x17x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.1 V/m
Peak SAR (extrapolated) = 0.411 W/kg
SAR(1 g) = 0.236 mW/g; SAR(10 g) = 0.141 mW/g



PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG-41312L; Type: Laptop PC with WWAN, WLAN, LTE and Bluetooth
Serial: DVT15590 1800004

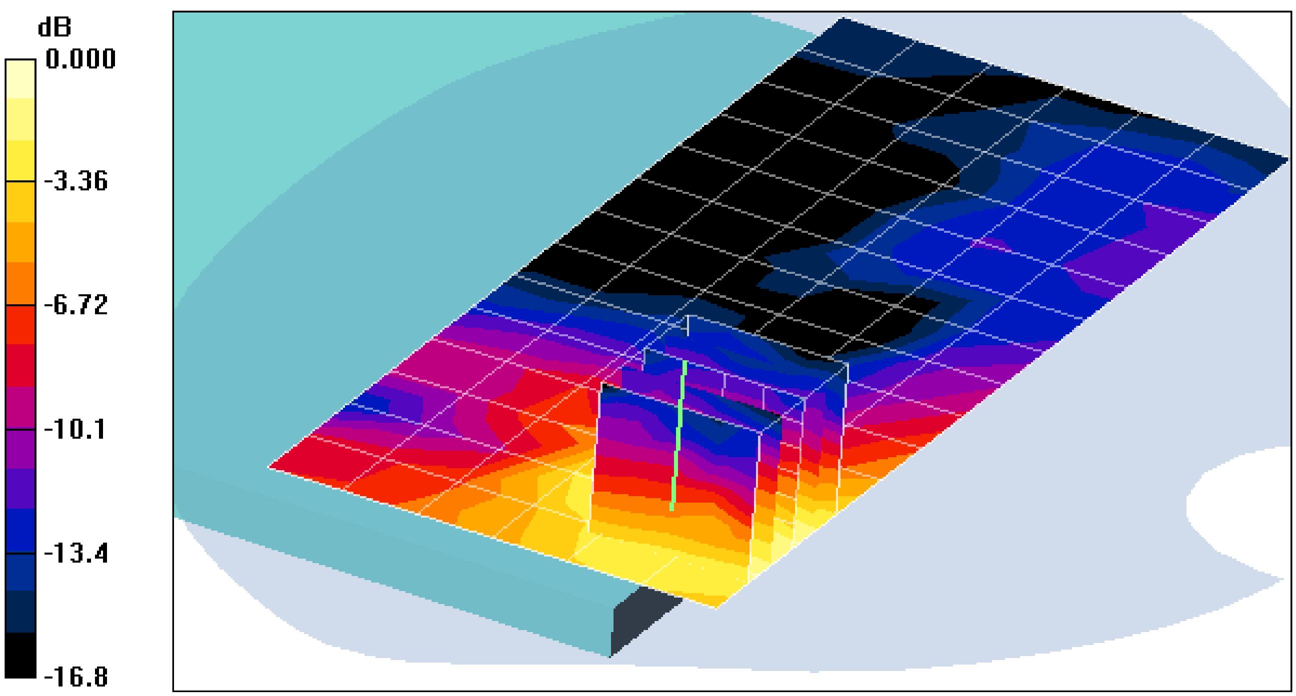
Communication System: PCS CDMA; Frequency: 1851.25 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1851.25 MHz; σ = 1.55 mho/m; ε_r = 52.1; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-06-2011; Ambient Temp: 23.7°C; Tissue Temp: 21.9°C

Probe: EX3DV4 - SN3561; ConvF(6.59, 6.59, 6.59); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: PCS CDMA EVDO RTAP, Body SAR, Laptop Position, Low ch

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.84 V/m
Peak SAR (extrapolated) = 0.226 W/kg
SAR(1 g) = 0.135 mW/g; SAR(10 g) = 0.075 mW/g



0 dB = 0.146mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG-41312L; Type: Laptop PC with WWAN, WLAN, LTE and Bluetooth
Serial: DVT15590 1800004

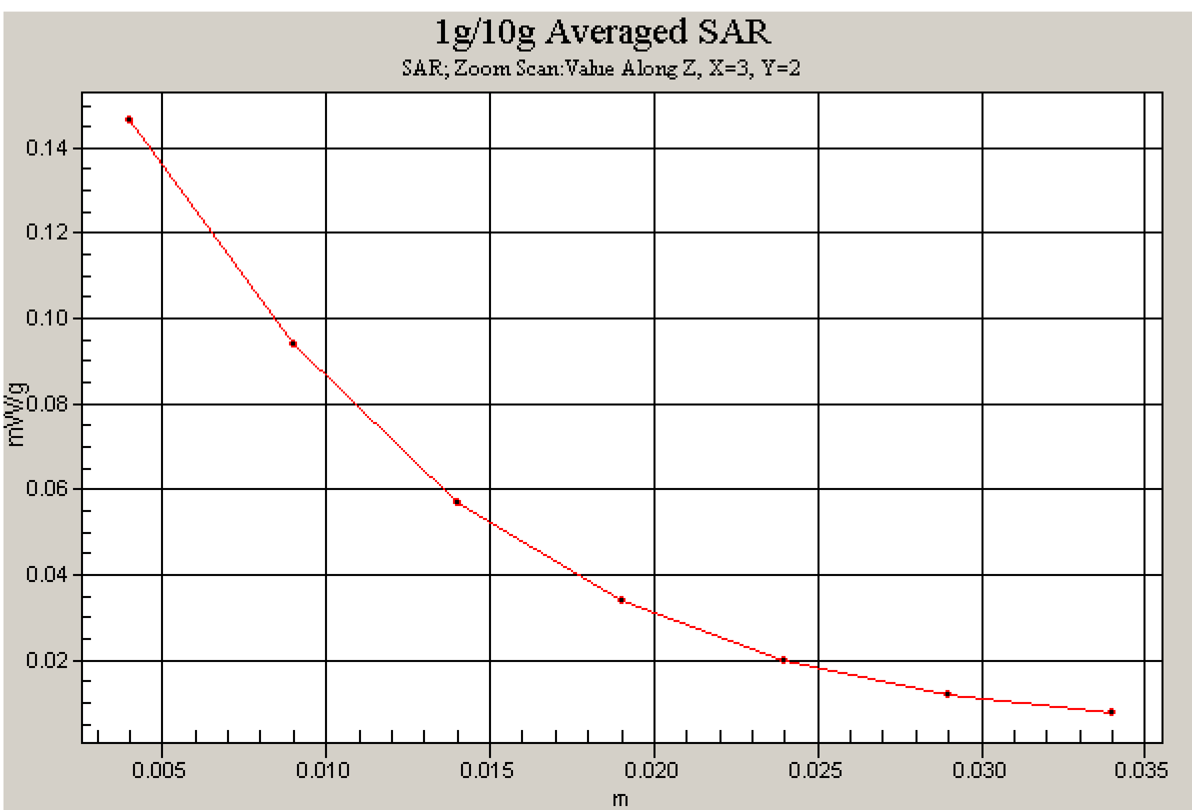
Communication System: PCS CDMA; Frequency: 1851.25 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1851.25 MHz; σ = 1.55 mho/m; ε_r = 52.1; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-06-2011; Ambient Temp: 23.7°C; Tissue Temp: 21.9°C

Probe: EX3DV4 - SN3561; ConvF(6.59, 6.59, 6.59); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: PCS CDMA EVDO RTAP, Body SAR, Laptop Position, Low ch

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.84 V/m
Peak SAR (extrapolated) = 0.226 W/kg
SAR(1 g) = 0.135 mW/g; SAR(10 g) = 0.075 mW/g



PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG -41312L; Type: Laptop PC with WWAN, WLAN, LTE and Bluetooth
Serial: DVT15590 1800006

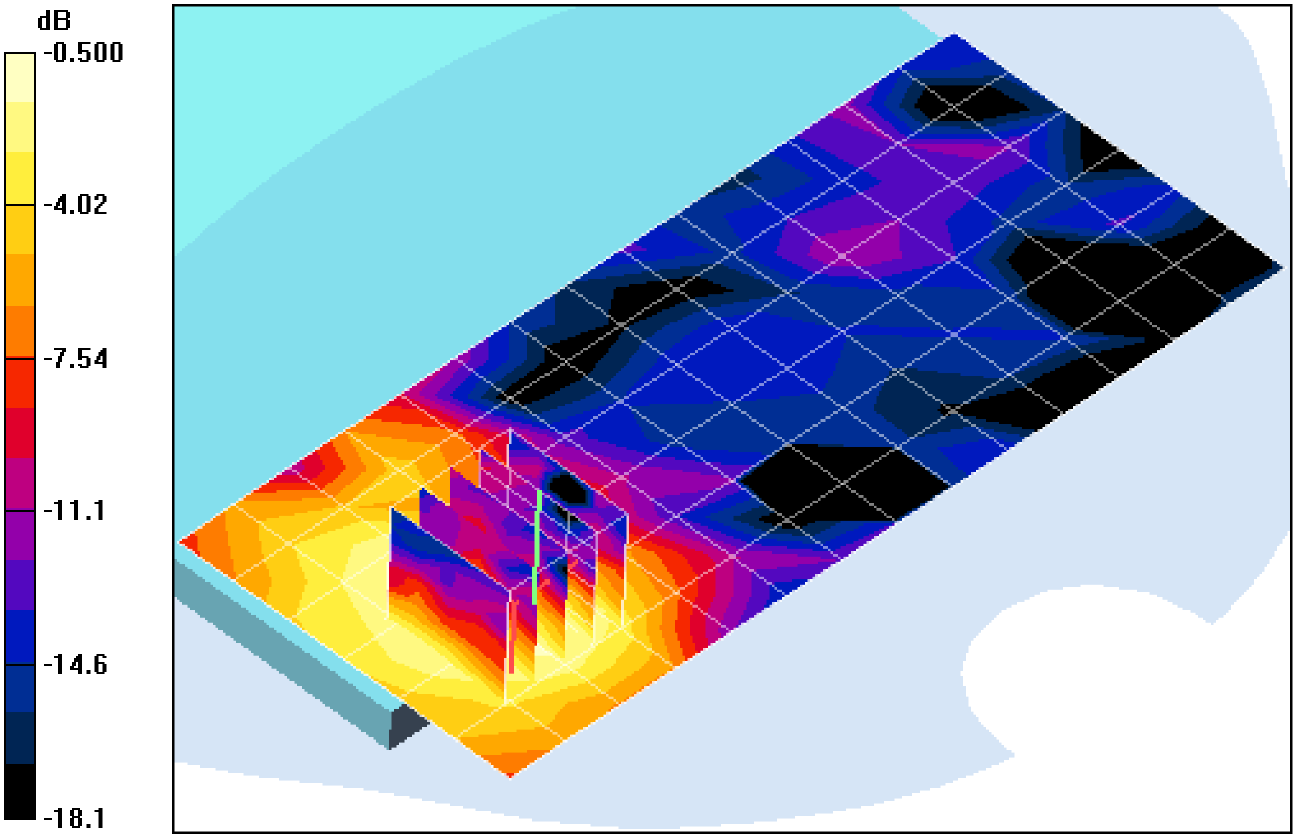
Communication System: IEEE 802.11n; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: 2450 Body; Medium parameters used (interpolated):
f = 2437 MHz; σ = 2.02 mho/m; ε_r = 50.8; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-06-2011; Ambient Temp: 24.2 °C; Tissue Temp: 22.6 °C

Probe: EX3DV4 - SN3550; ConvF(6.25, 6.25, 6.25); Calibrated: 2/14/2011
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: IEEE 802.11n, Body SAR, Laptop Position, Ch.06, 6.5 Mbps, Tx Chain 2

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.20 V/m
Peak SAR (extrapolated) = 0.064 W/kg
SAR(1 g) = 0.033 mW/g; SAR(10 g) = 0.018 mW/g



0 dB = 0.041mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG-41312L; Type: Laptop PC with WWAN, WLAN, LTE and Bluetooth
Serial: DVT15590 1800006

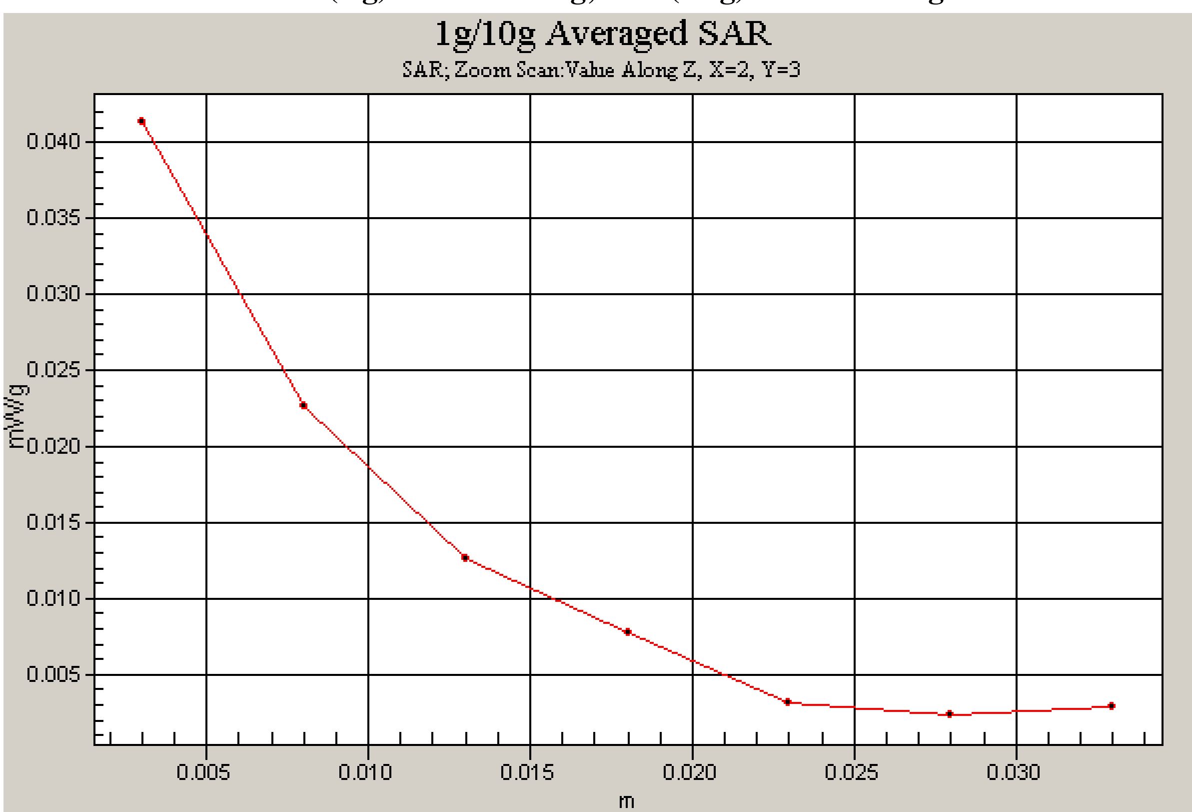
Communication System: IEEE 802.11b; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: 2450 Body; Medium parameters used (interpolated):
f = 2437 MHz; σ = 2.02 mho/m; ε_r = 50.8; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0. cm

Test Date: 04-06-2011; Ambient Temp: 24.2 °C; Tissue Temp: 22.6 °C

Probe: EX3DV4 - SN3550; ConvF(6.25, 6.25, 6.25); Calibrated: 2/14/2011
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: IEEE 802.11n, Body SAR, Laptop Position, Ch.06, 6.5 Mbps, Tx Chain 2

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.20 V/m
Peak SAR (extrapolated) = 0.064 W/kg
SAR(1 g) = 0.033 mW/g; SAR(10 g) = 0.018 mW/g



PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG-41312L; Type: Laptop PC with WWAN, WLAN, LTE and Bluetooth
Serial: DVT15590 1800006

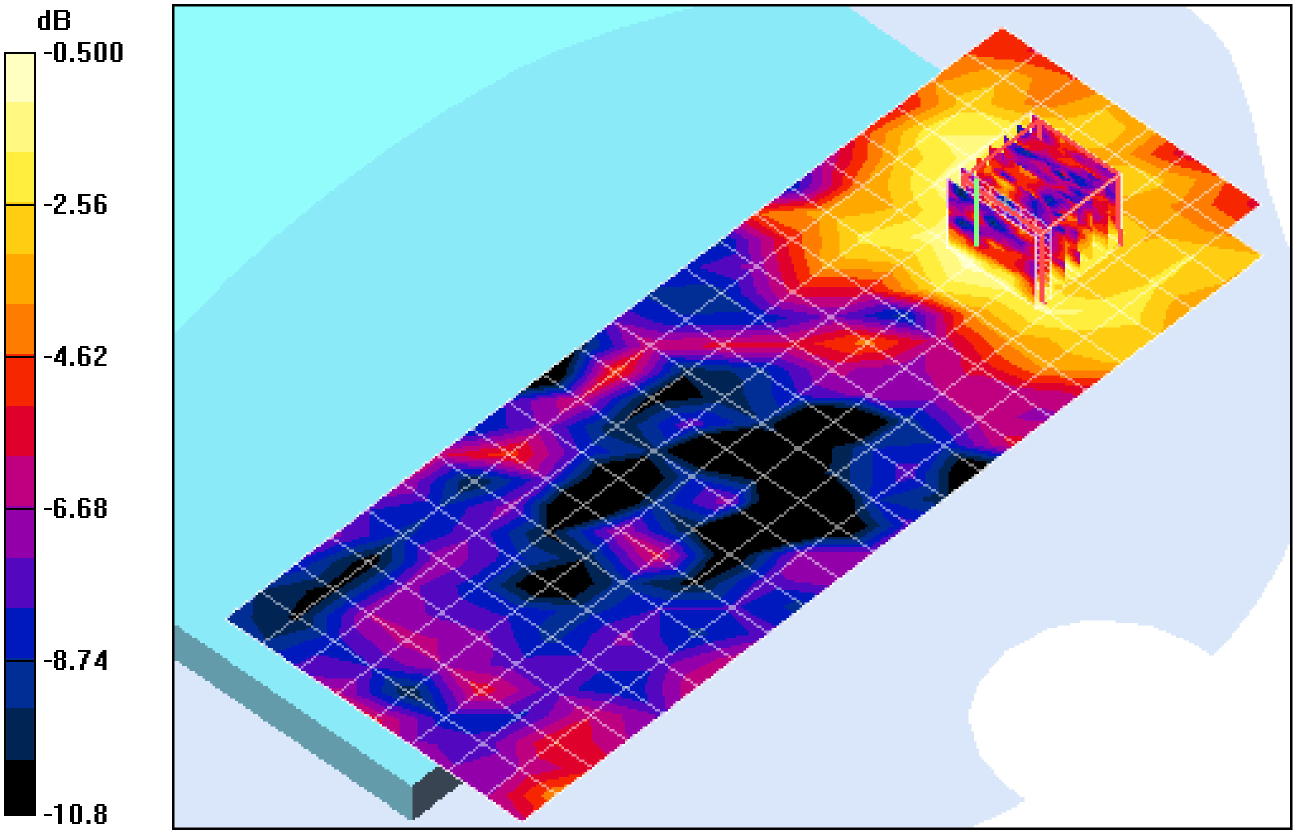
Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body M;edium parameters used (interpolated):
f = 5200 MHz; σ = 5.44 mho/m; ε_r = 47.1; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0. cm

Test Date: 04-05-2011; Ambient Temp: 24.3 °C; Tissue Temp: 22.7 °C

Probe: EX3DV4 - SN3550; ConvF(3.58, 3.58, 3.58); Calibrated: 2/14/2011
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WLAN 802.11a 5.2 GHz, Laptop position, Ch.40, 6Mbps, Tx Chain 1

Area Scan (9x23x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 3.48 V/m
Peak SAR (extrapolated) = 0.433 W/kg
SAR(1 g) = 0.052 mW/g; SAR(10 g) = 0.035 mW/g



0 dB = 0.091mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG -41312L; Type: Laptop PC with WWA N, WLAN, LTE and Bluetooth
Serial: DVT15590 1800006

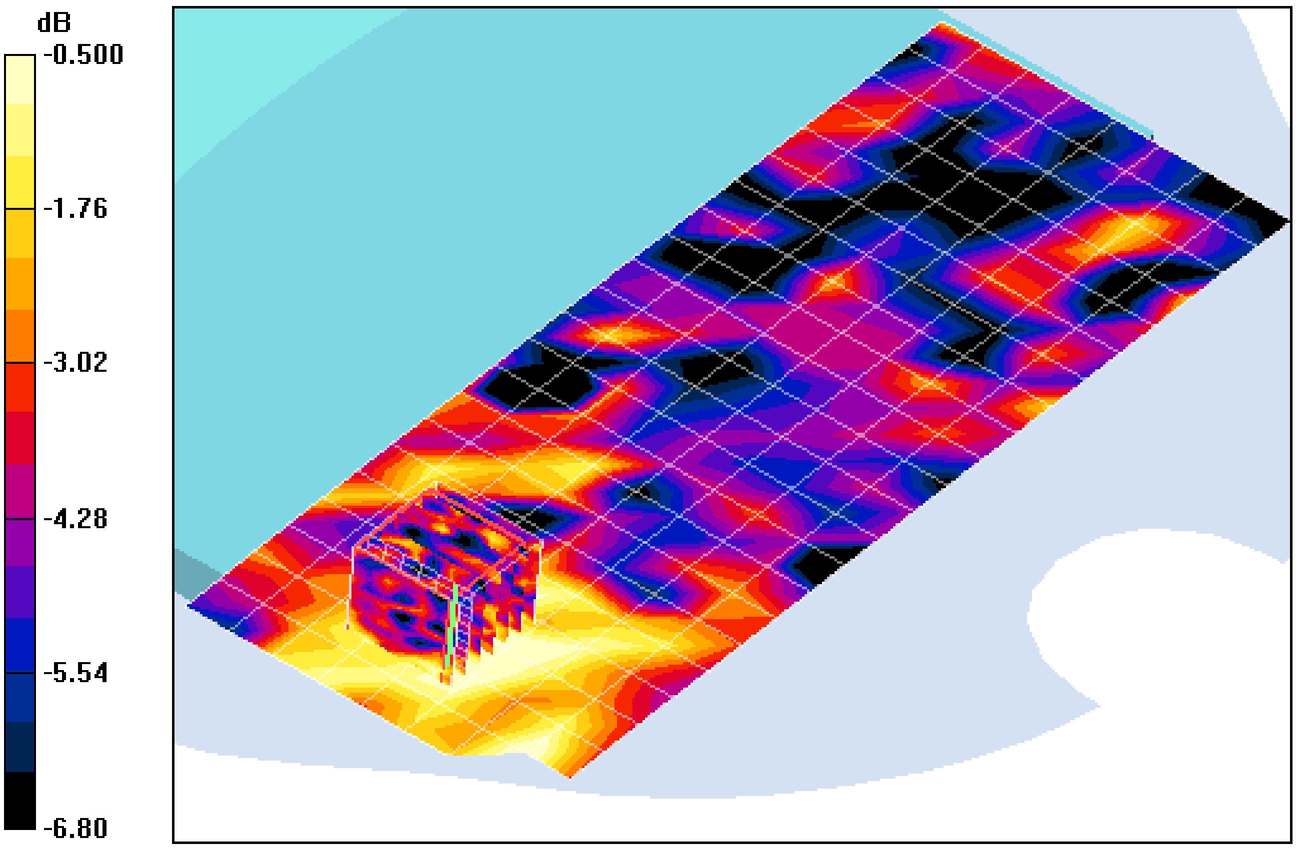
Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body; Medium parameters used (interpolated):
f = 5200 MHz; σ = 5.44 mho/m; ε_r = 47.1; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0. cm

Test Date: 04-05-2011; Ambient Temp:24.3 °C; Tissue Temp: 22.7 °C

Probe: EX3DV4 - SN3550; ConvF(3.58, 3.58, 3.58); Calibrated: 2/14/2011
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WLAN 802.11a 5.2 GHz, Laptop position, Ch.40, 6Mbps, Tx Chain 2

Area Scan (9x23x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 1.09 V/m
Peak SAR (extrapolated) = 0.071 W/kg
SAR(1 g) = 0.028 mW/g; SAR(10 g) = 0.022 mW/g



0 dB = 0.048mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG -41312L; Type: Laptop PC with WWA N, WLAN, LTE and Bluetooth
Serial: DVT15590 1800006

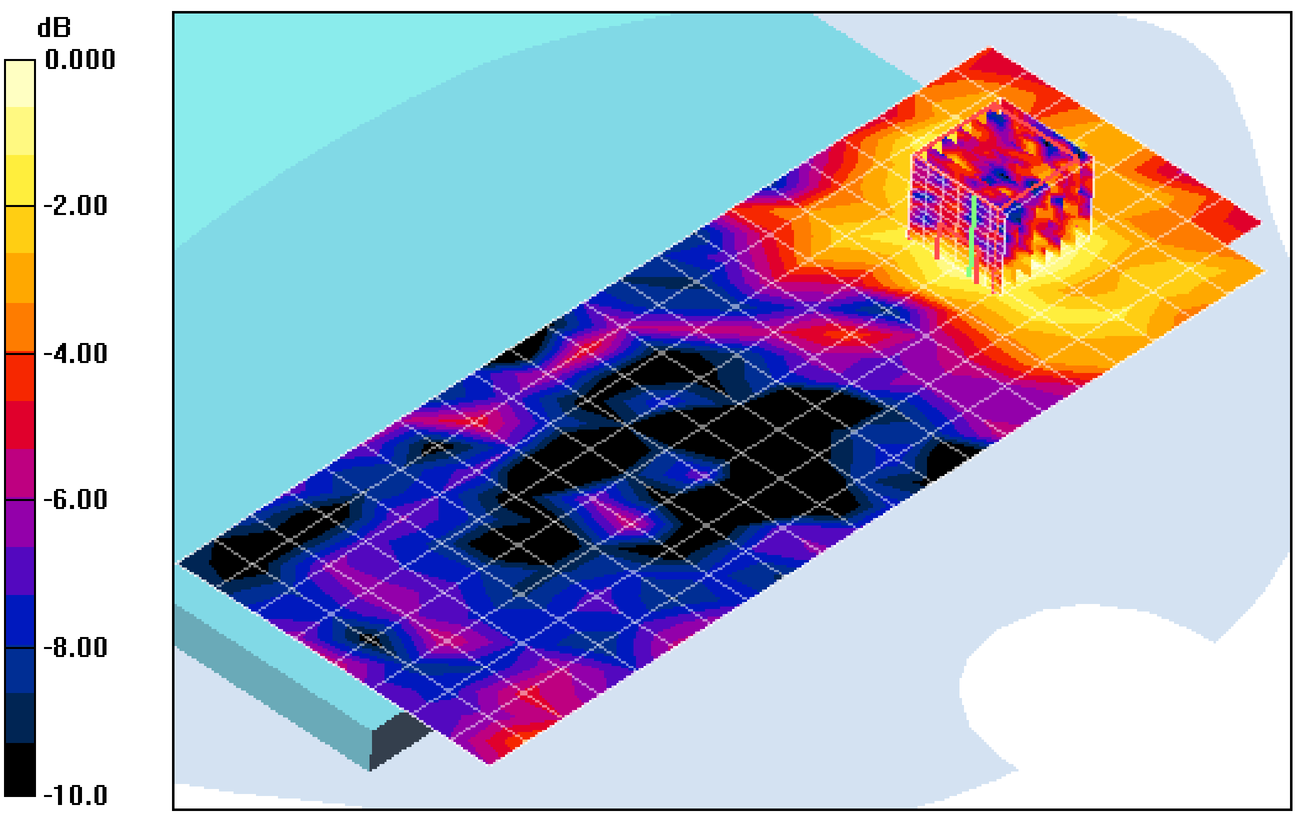
Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5320 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body; Medium parameters used (interpolated):
f = 5320 MHz; σ = 5.62 mho/m; ε_r = 46.9; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-05-2011; Ambient Temp: 24.3 °C; Tissue Temp: 22.7 °C

Probe: EX3DV4 - SN3550; F(3.31, 3.31, 3.31); Calibrated: 2/14/2011
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WLAN 802.11a 5.3 GHz, Laptop position, Ch.64, 6Mbps, Tx Chain 1

Area Scan (9x23x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 1.10 V/m
Peak SAR (extrapolated) = 0.054 W/kg
SAR(1 g) = 0.025 mW/g; SAR(10 g) = 0.019 mW/g



0 dB = 0.046mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG-41312L; Type: Laptop PC with WWAN, WLAN, LTE and Bluetooth
Serial: DVT15590 1800006

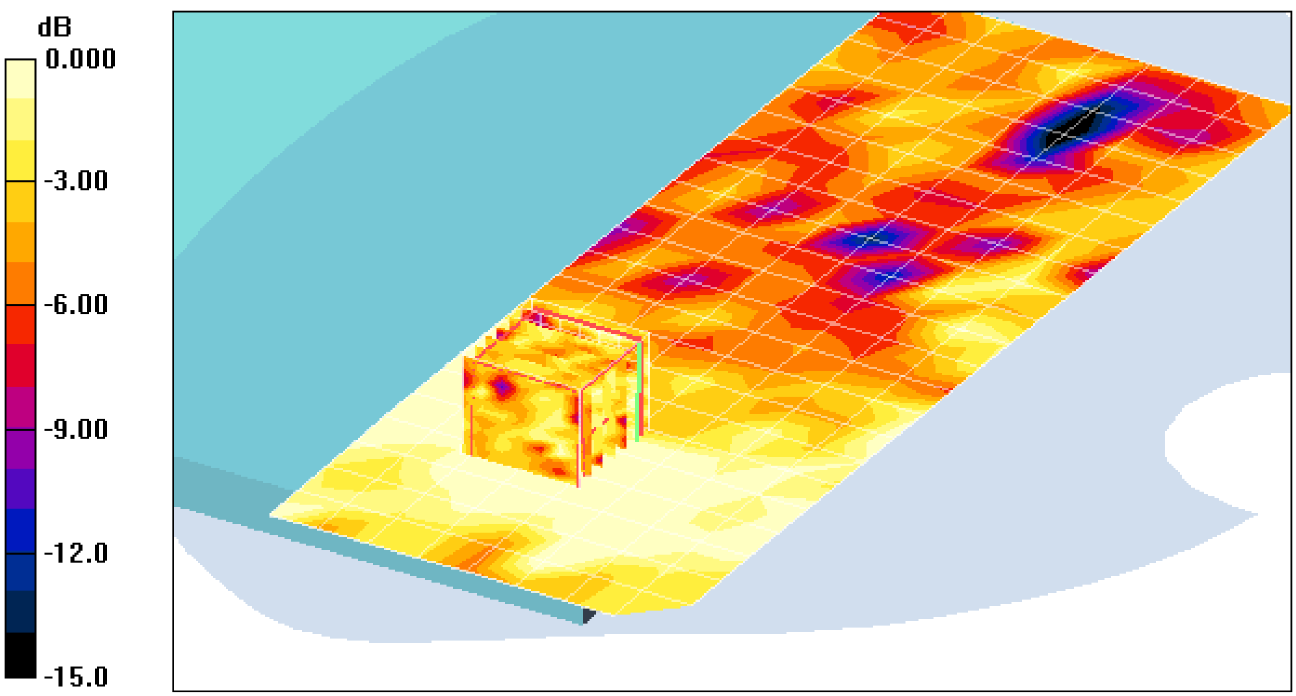
Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5320 MHz;Duty Cycle: 1:1
Medium: 5 GHz Medium parameters used (interpolated):
$f = 5320$ MHz; $\sigma = 5.62$ mho/m; $\varepsilon_r = 46.9$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-05-2011; Ambient Temp: 24.3 °C; Tissue Temp: 22.7 °C

Probe: EX3DV4 - SN3550; ConvF(3.31, 3.31, 3.31); Calibrated: 2/14/2011
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WLAN 802.11a 5.3 GHz, Laptop position, Ch.64, 6Mbps, Tx Chain 2

Area Scan (9x23x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 0.908 V/m
Peak SAR (extrapolated) = 0.126 W/kg
SAR(1 g) = 0.030 mW/g; SAR(10 g) = 0.023 mW/g



0 dB = 0.048mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG -41312L; Type: Laptop PC with WWA N, WLAN, LTE and Bluetooth
Serial: DVT15590 1800006

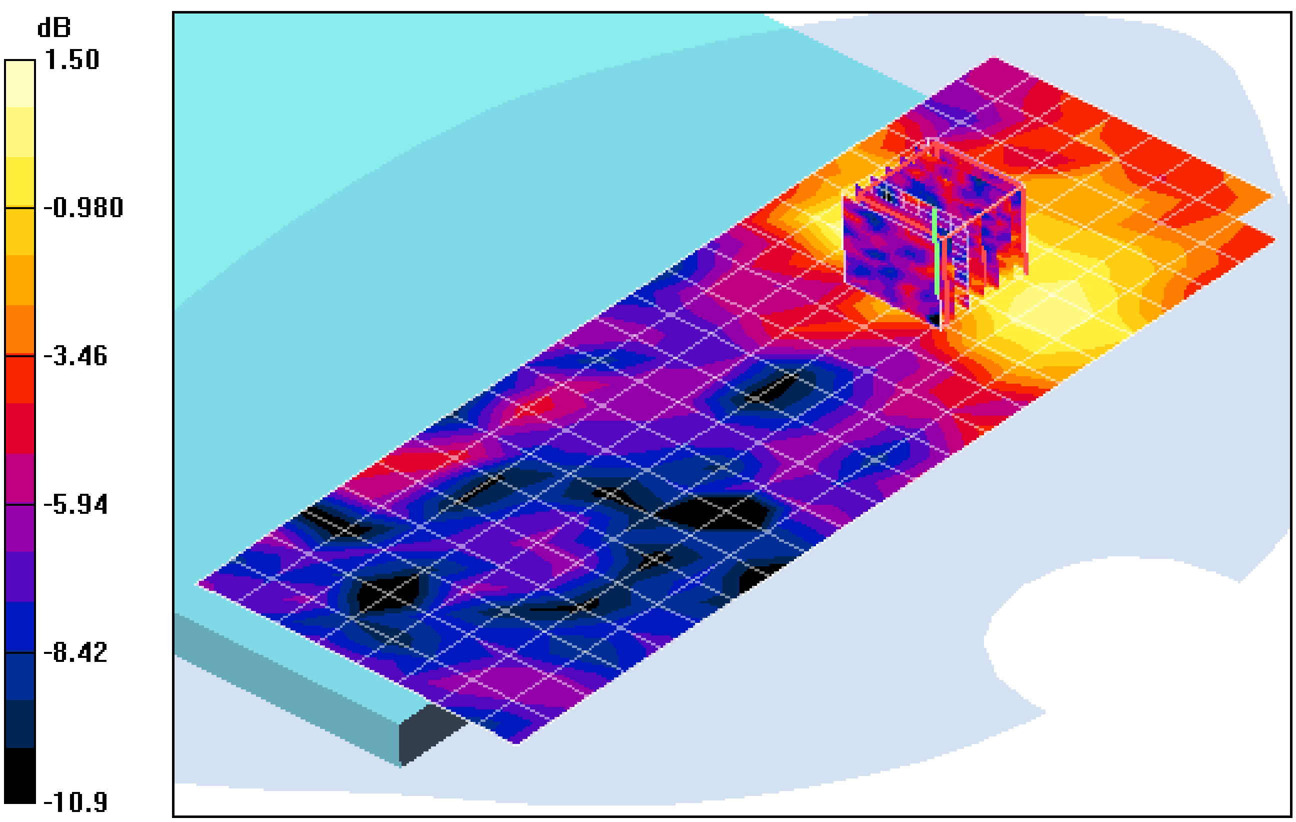
Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5500 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body; Medium parameters used (interpolated):
f = 5500 MHz; σ = 5.87 mho/m; ε_r = 46.6; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-05-2011; Ambient Temp: 24.5 °C; Tissue Temp: 22.8 °C

Probe: EX3DV4 - SN3550; ConvF(3.21, 3.21, 3.21); Calibrated: 2/14/2011
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WLAN 802.11a 5.5 GHz, Laptop position, Ch.100, 6Mbps, Tx chain 1

Area Scan (9x23x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 2.86 V/m
Peak SAR (extrapolated) = 0.423 W/kg
SAR(1 g) = 0.058 mW/g; SAR(10 g) = 0.035 mW/g



0 dB = 0.103mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG -41312L; Type: Laptop PC with WWA N, WLAN, LTE and Bluetooth
Serial: DVT15590 1800006

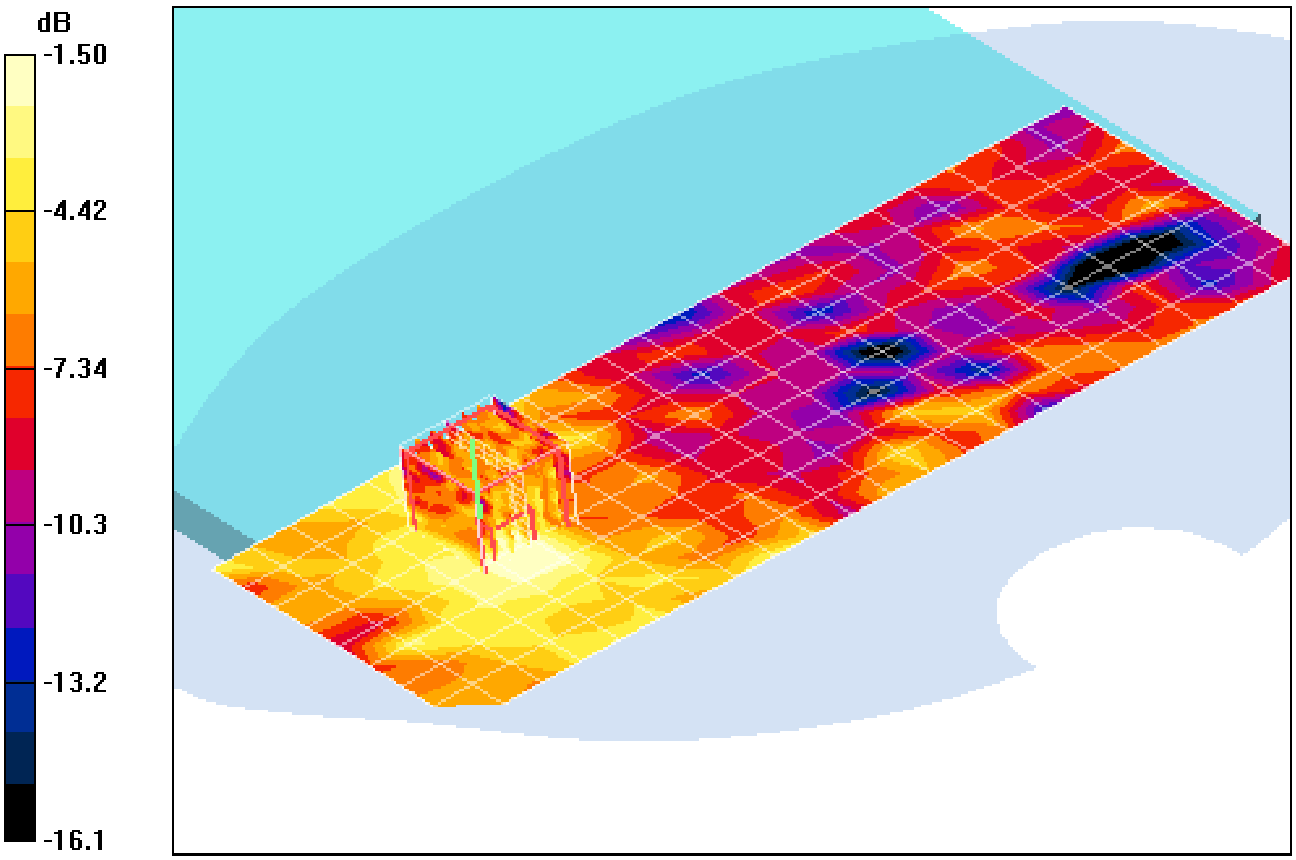
Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5500 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body; Medium parameters used (interpolated):
f = 5500 MHz; σ = 5.87 mho/m; ε_r = 46.6; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-05-2011; Ambient Temp: 24.5 °C; Tissue Temp: 22.8 °C

Probe: EX3DV4 - SN3550; ConvF(3.21, 3.21, 3.21); Calibrated: 2/14/2011
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WLAN 802.11a 5.5 GHz, Laptop position, Ch.100, 6Mbps, Tx Chain 2

Area Scan (9x23x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 3.19 V/m
Peak SAR (extrapolated) = 0.144 W/kg
SAR(1 g) = 0.056 mW/g; SAR(10 g) = 0.033 mW/g



0 dB = 0.097mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG -41312L; Type: Laptop PC with WWA N, WLAN, LTE and Bluetooth
Serial: DVT15590 1800006

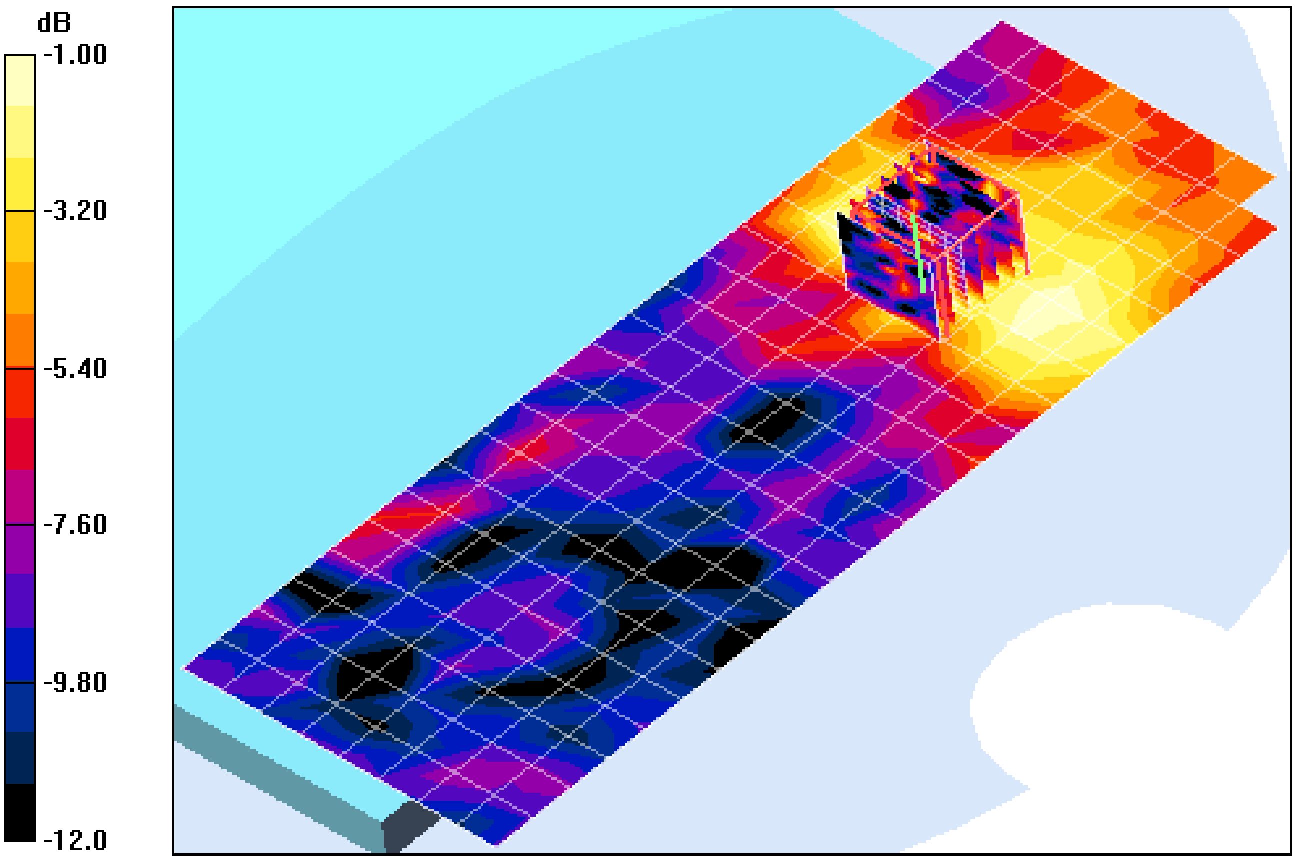
Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5745 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body; Medium parameters used (interpolated):
f = 5745 MHz; $\sigma = 6.23$ mho/m; $\varepsilon_r = 46.1$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 0.0. cm

Test Date: 04-05-2011; Ambient Temp:24.6 °C; Tissue Temp: 22.9 °C

Probe: EX3DV4 - SN3550; ConvF(3.29, 3.29, 3.29); Calibrated: 2/14/2011
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WLAN 802.11a 5.8 GHz, Laptop position, Ch.149, 6Mbps, Tx Chain 1

Area Scan (9x23x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 3.04 V/m
Peak SAR (extrapolated) = 0.884 W/kg
SAR(1 g) = 0.086 mW/g; SAR(10 g) = 0.044 mW/g



0 dB = 0.154mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1057

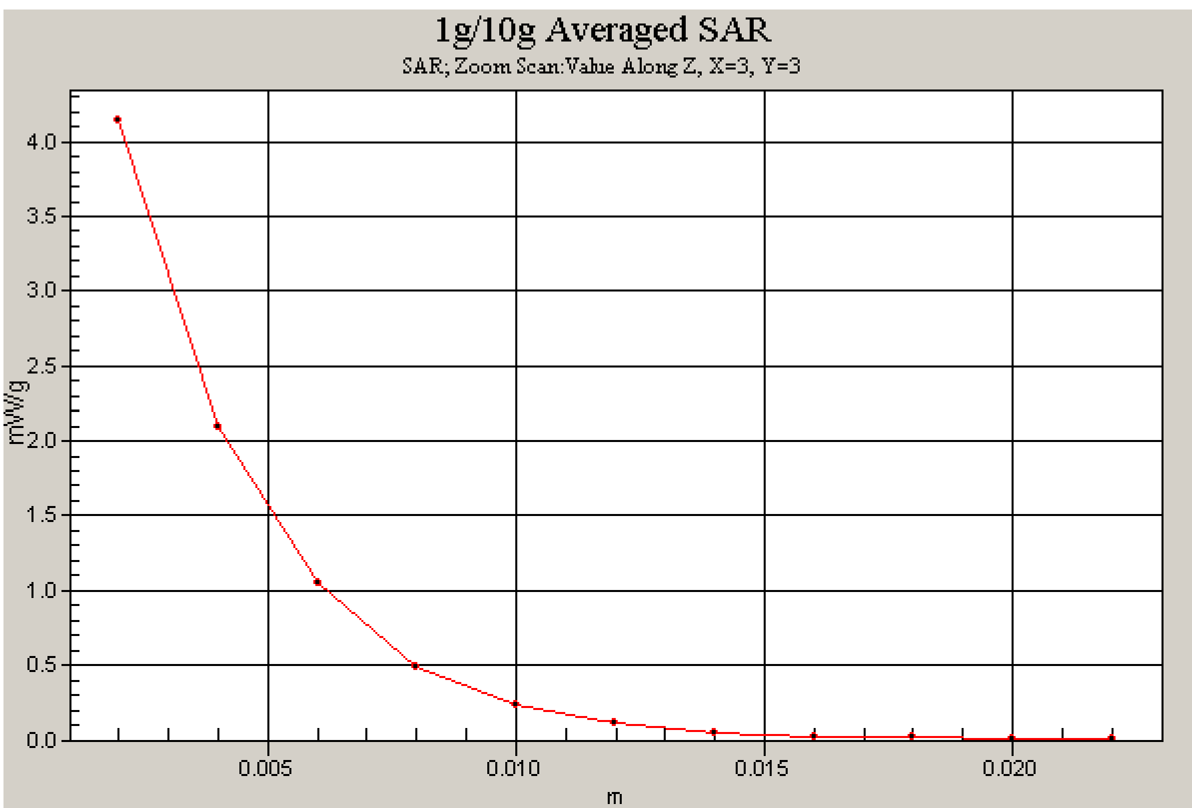
Communication System: CW; Frequency: 5800 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body; Medium parameters used (interpolated):
f = 5800 MHz; σ = 6.28 mho/m; ε_r = 46; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-05-2011; Ambient Temp: 24.6 °C; Tissue Temp: 22.9 °C

Probe: EX3DV4 - SN3550; ConvF(3.29, 3.29, 3.29); Calibrated: 2/14/2011
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

5800MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Input Power = 14.0 dBm (25 mW)
SAR(1 g) = 1.93 mW/g; SAR(10 g) = 0.527 mW/g
Deviation = 2.93 %



PCTEST ENGINEERING LABORATORY, INC.

DUT: PCG -41312L; Type: Laptop PC with WWA N, WLAN, LTE and Bluetooth
Serial: DVT15590 1800006

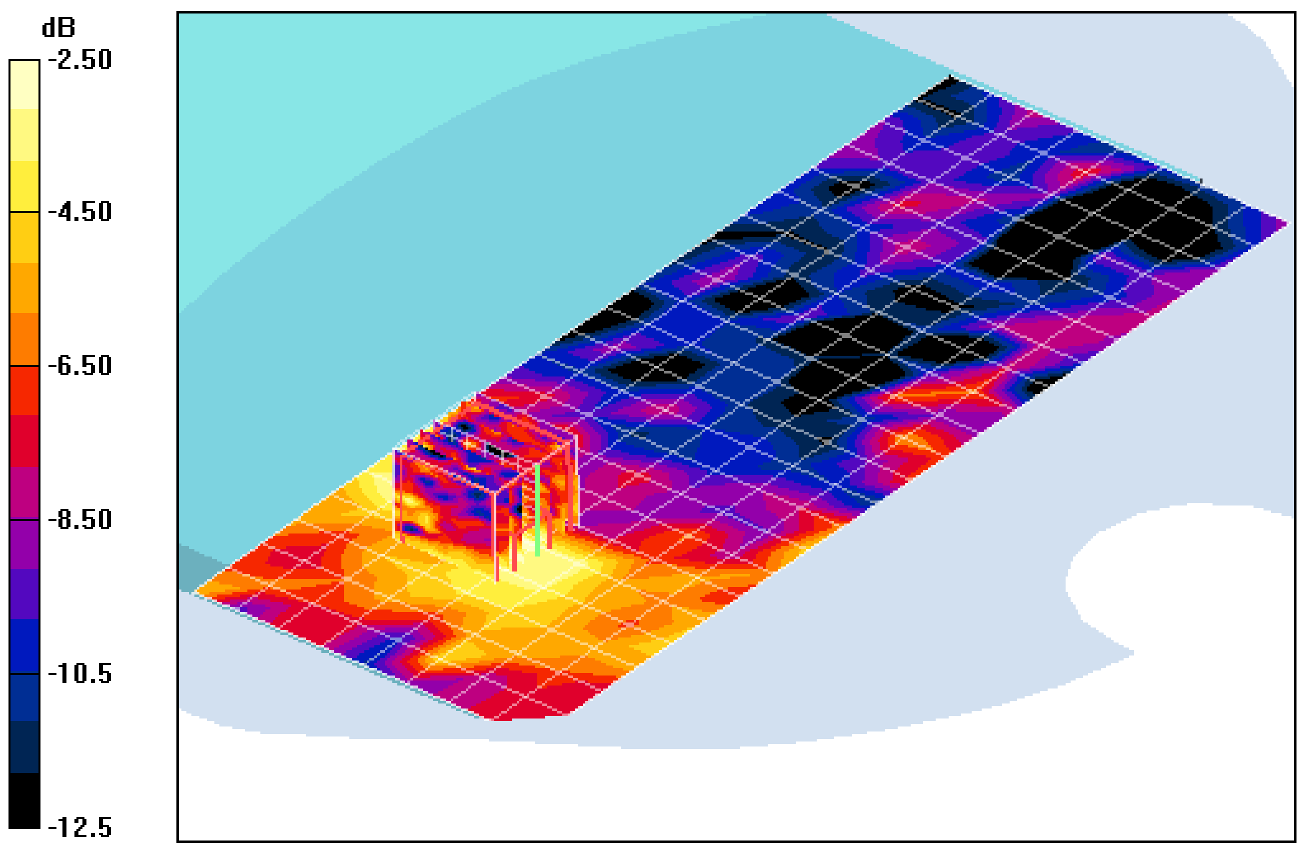
Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5745 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body; Medium parameters used (interpolated):
f = 5745 MHz; σ = 6.23 mho/m; ε_r = 46.1; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0. cm

Test Date: 04-05-2011; Ambient Temp:24.6 °C; Tissue Temp: 22.9 °C

Probe: EX3DV4 - SN3550; ConvF(3.29, 3.29, 3.29); Calibrated: 2/14/2011
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: WLAN 802.11a 5.8 GHz, Laptop position, Ch.149, 6Mbps, Tx Chain 2

Area Scan (9x23x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 1.44 V/m
Peak SAR (extrapolated) = 0.515 W/kg
SAR(1 g) = 0.080 mW/g; SAR(10 g) = 0.035 mW/g



0 dB = 0.150mW/g

APPENDIX B: DIPOLE VALIDATION

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 750 MHz; Type: D750V3; Serial: 1003

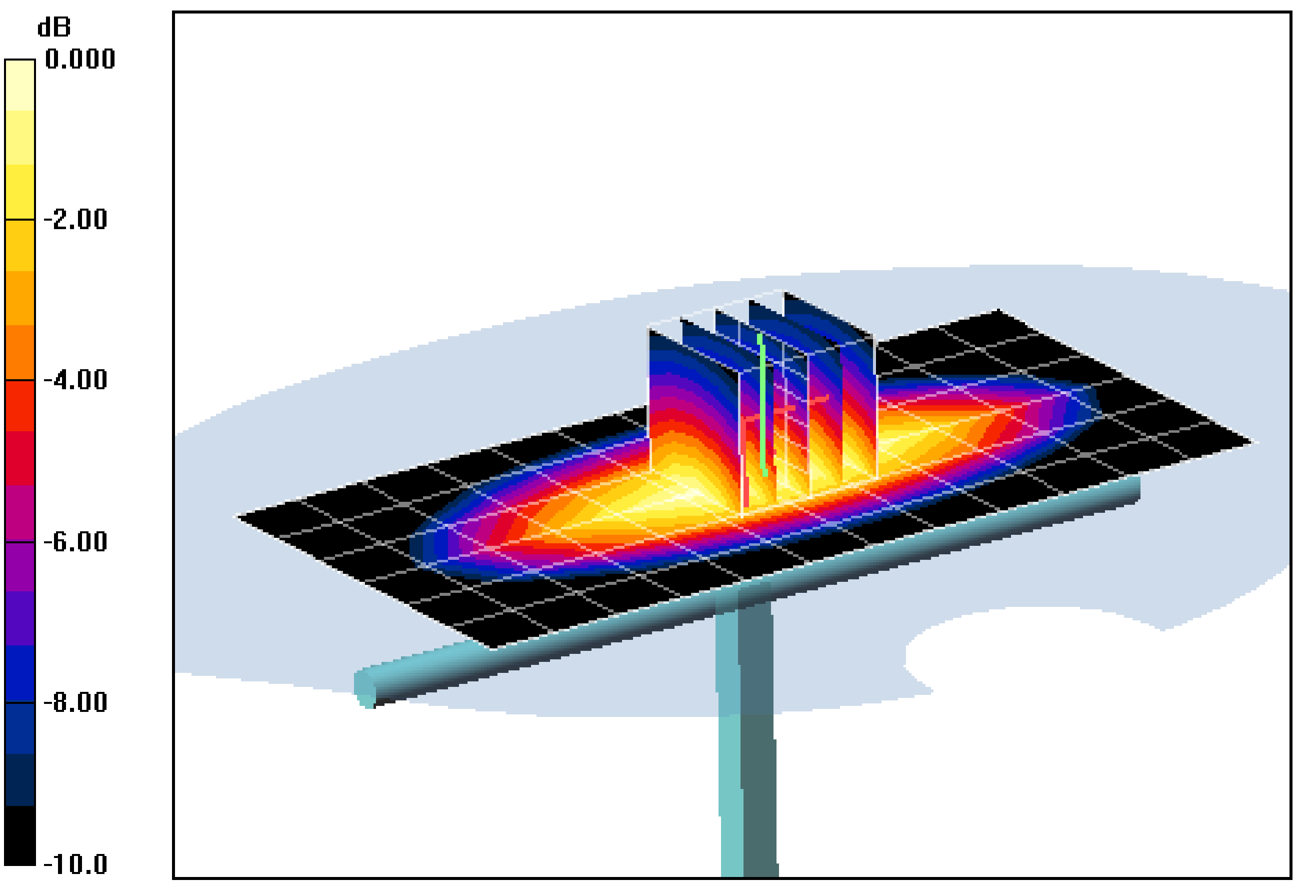
Communication System: CW; Frequency: 750 MHz;Duty Cycle: 1:1
Medium: 740 Body Medium parameters used (interpolated):
f = 750 MHz; $\sigma = 0.931$ mho/m; $\varepsilon_r = 53.4$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 04-05-2011; Ambient Temp: 24.7°C; Tissue Temp: 22.9°C

Probe: ES3DV2 - SN3022; ConvF(6.09, 6.09, 6.09); Calibrated: 9/21/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn704; Calibrated: 3/17/2011
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

750MHz System Verification

Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 24 dBm (250 mW)
SAR(1 g) = 2.1 mW/g; SAR(10 g) = 1.39 mW/g
Deviation = -5.08 %



0 dB = 2.27mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d047

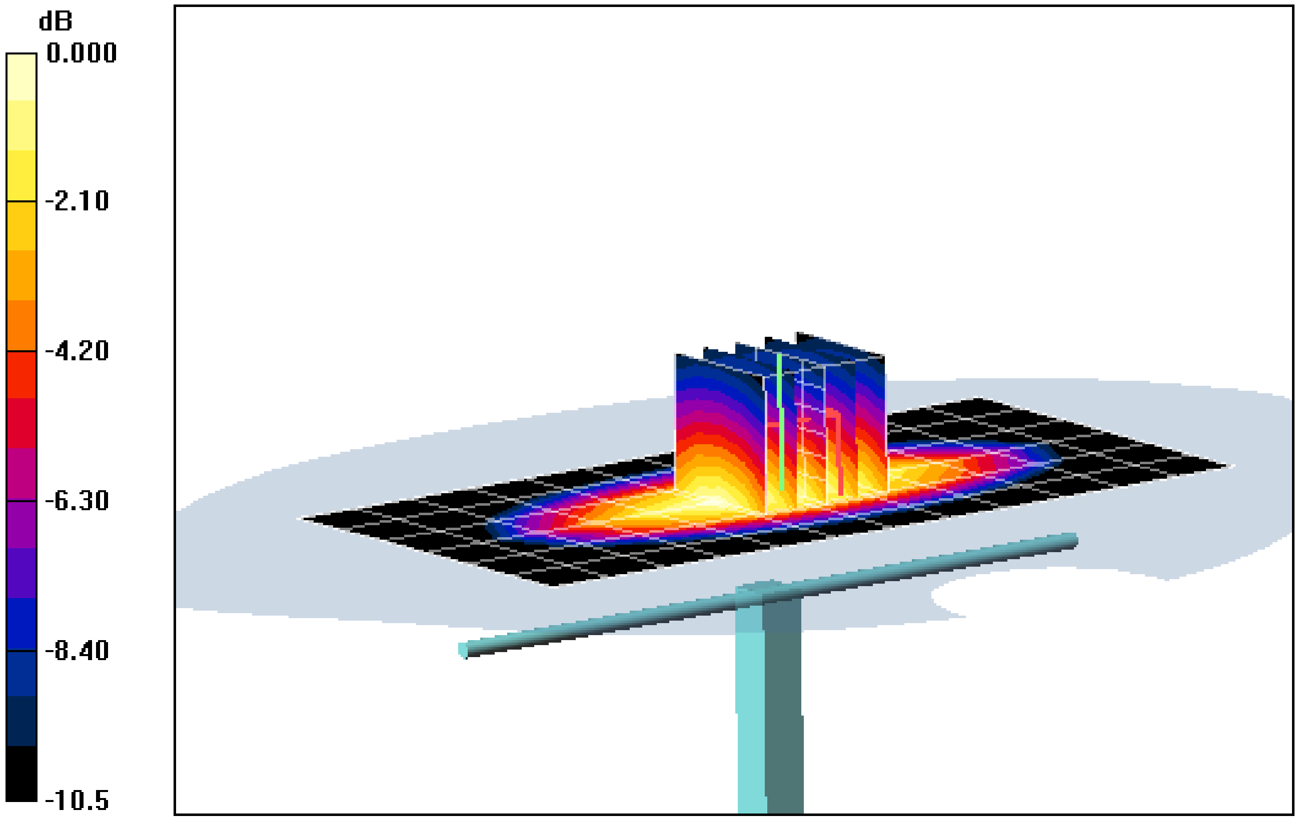
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used:
f = 835 MHz; σ = 0.944 mho/m; ε_r = 53.8; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 04-04-2011; Ambient Temp: 23.9 °C; Tissue Temp: 22.0 °C

Probe: EX3DV4 - SN3561; ConvF(8.09, 8.09, 8.09); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

835MHz System Verification

Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 18.0 dBm (63 mW)
SAR(1 g) = 0.615 mW/g; SAR(10 g) = 0.402 mW/g
Deviation = -0.89 %



0 dB = 0.660mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d026

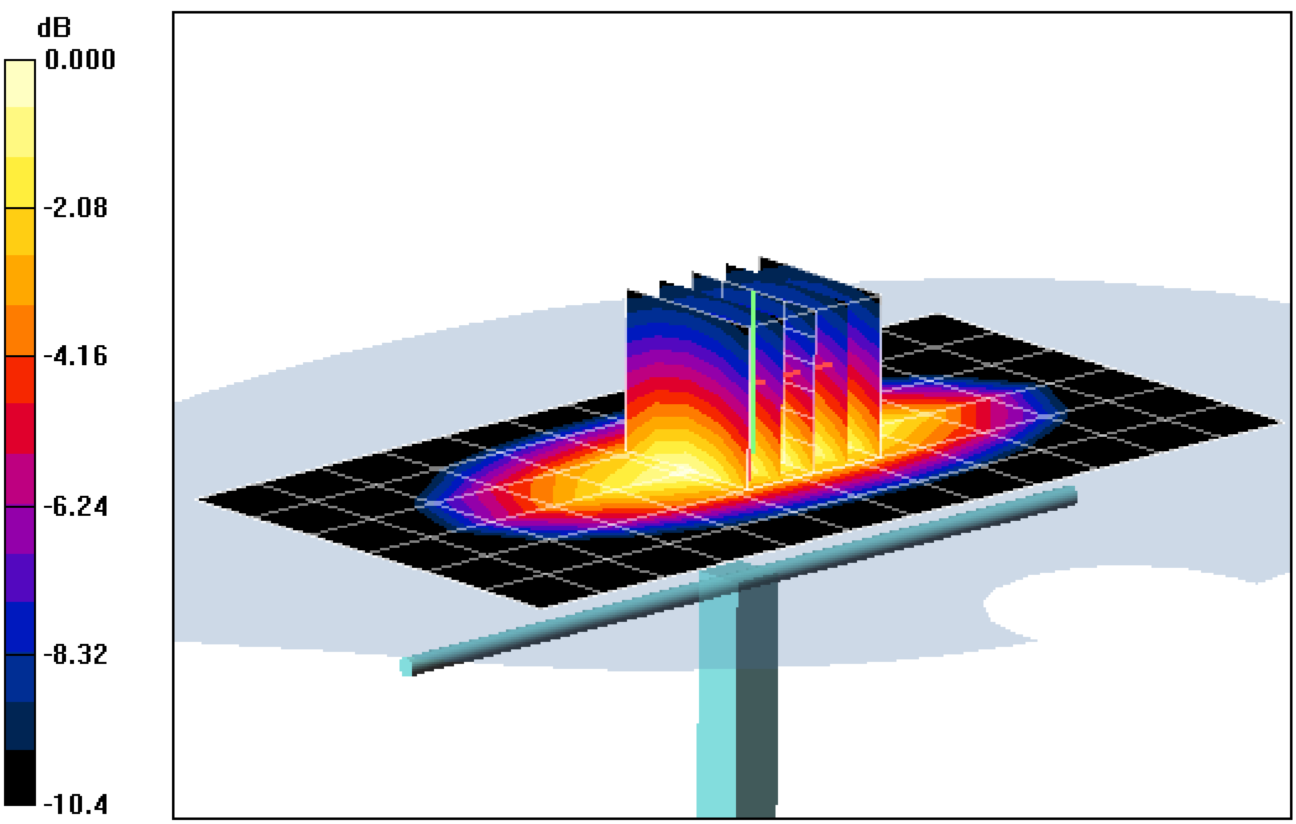
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: 835 Body; Medium parameters used:
f = 835 MHz; σ = 1.01 mho/m; ε_r = 54.9; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 04-08-2011; Ambient Temp: 24.3 ° C; Tissue Temp: 22.5 °C

Probe: EX3DV4 - SN3550; ConvF(8.11, 8.11, 8.11); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

835MHz System Verification

Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
SAR(1 g) = 1.02 mW/g; SAR(10 g) = 0.668 mW/g
Deviation = 4.29 %



0 dB = 1.10mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 502

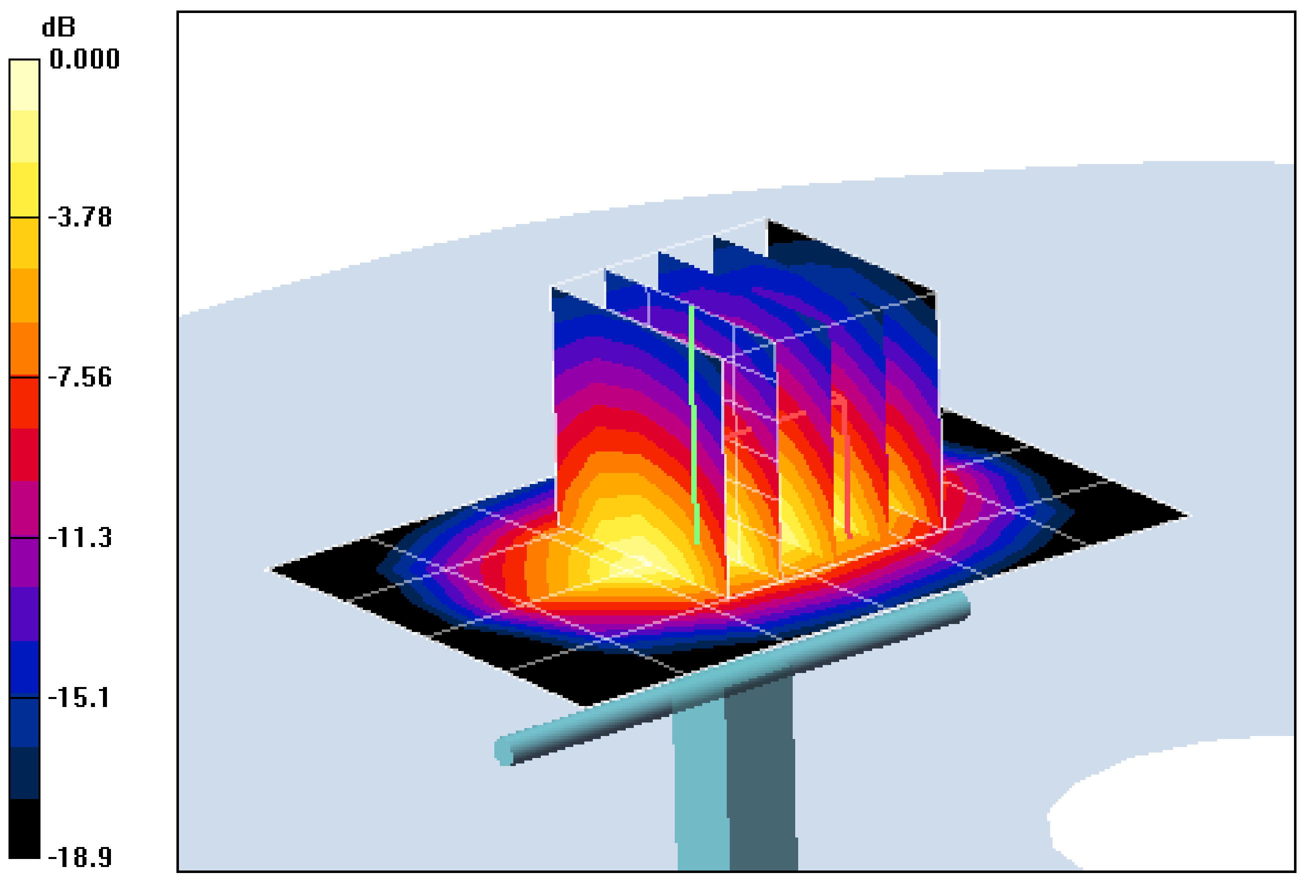
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.56 mho/m; ε_r = 50.8; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-22-2011; Ambient Temp: 24.1°C; Tissue Temp: 22.7°C

Probe: EX3DV4 - SN3550; ConvF(6.77, 6.77, 6.77); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

1900MHz System Verification

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 16 dBm (40 mW)
SAR(1 g) = 1.75 mW/g; SAR(10 g) = 0.891 mW/g
Deviation = 6.45 %



0 dB = 1.94mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 502

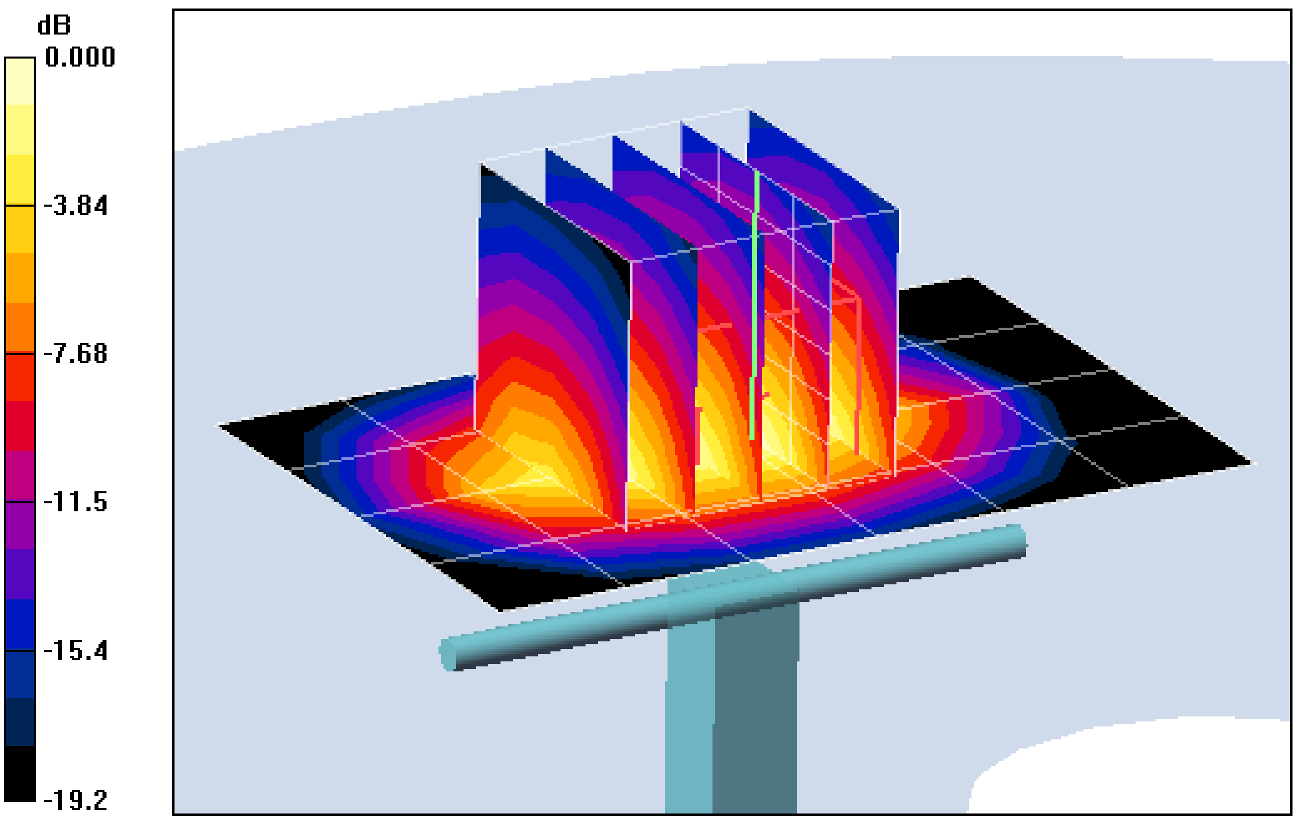
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: 1900 Body; Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.57 mho/m; ε_r = 51; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0. cm

Test Date: 03-29-2011; Ambient Temp: 24.2 ° C; Tissue Temp: 22.7 °C

Probe: EX3DV4 - SN3550; ConvF(6.77, 6.77, 6.77); Calibrated: 2/14/2011
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

1900MHz System Verification

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 16.0 dBm (40 mW)
SAR(1 g) = 1.69 mW/g; SAR(10 g) = 0.861 mW/g
Deviation = 2.80 %



0 dB = 1.85mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 502

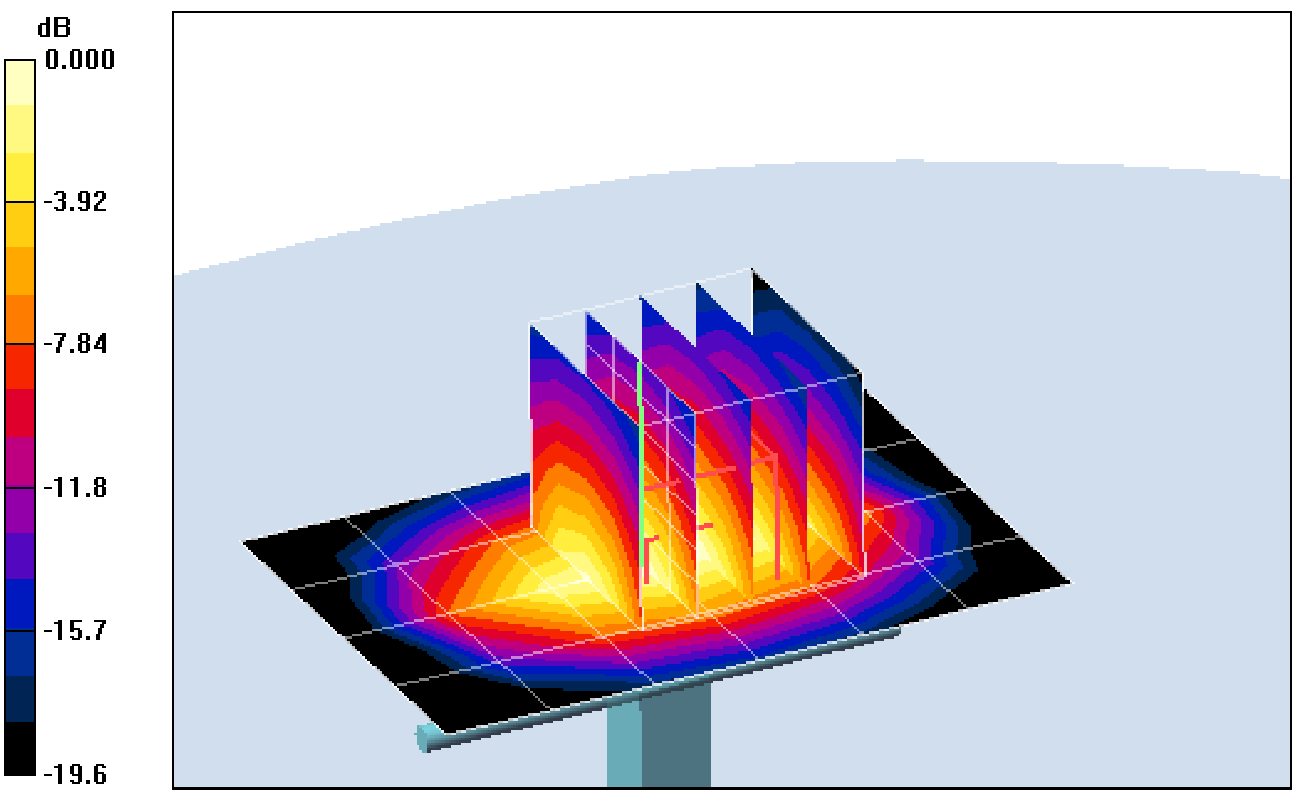
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.58 mho/m; ε_r = 51.9; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-06-2011; Ambient Temp: 23.7°C; Tissue Temp: 21.9°C

Probe: EX3DV4 - SN3561; ConvF(6.59, 6.59, 6.59); Calibrated: 8/19/2010
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/21/2011
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

1900MHz System Verification

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 16 dBm (40 mW)
SAR(1 g) = 1.7 mW/g; SAR(10 g) = 0.870 mW/g
Deviation = 3.41 %



0 dB = 1.89mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 2450 MHz; Type: D2450V2; Serial: 719

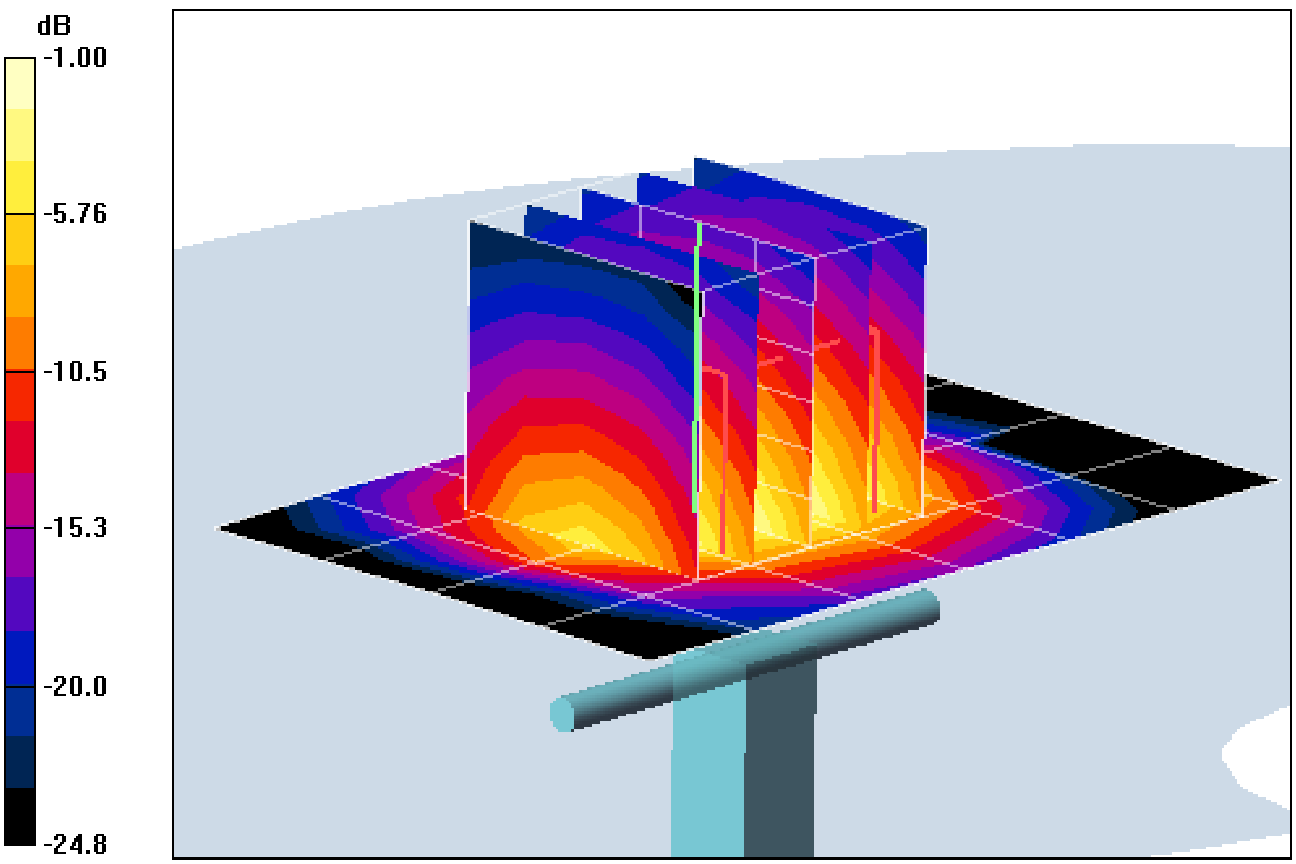
Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: 2450 Body; Medium parameters used:
f = 2450 MHz; σ = 2.04 mho/m; ε_r = 50.8; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-06-2011; Ambient Temp: 24.2 °; Tissue Temp: 22.6 °C

Probe: EX3DV4 - SN3550; ConvF(6.25, 6.25, 6.25); Calibrated: 2/14/2011
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

2450MHz System Verification

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 14.0 dBm (25 mW)
SAR(1 g) = 1.34 mW/g; SAR(10 g) = 0.608 mW/g
Deviation = 4.28 %



0 dB = 1.75mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5200 MHz; Type: D5GHzV2; Serial: 1057

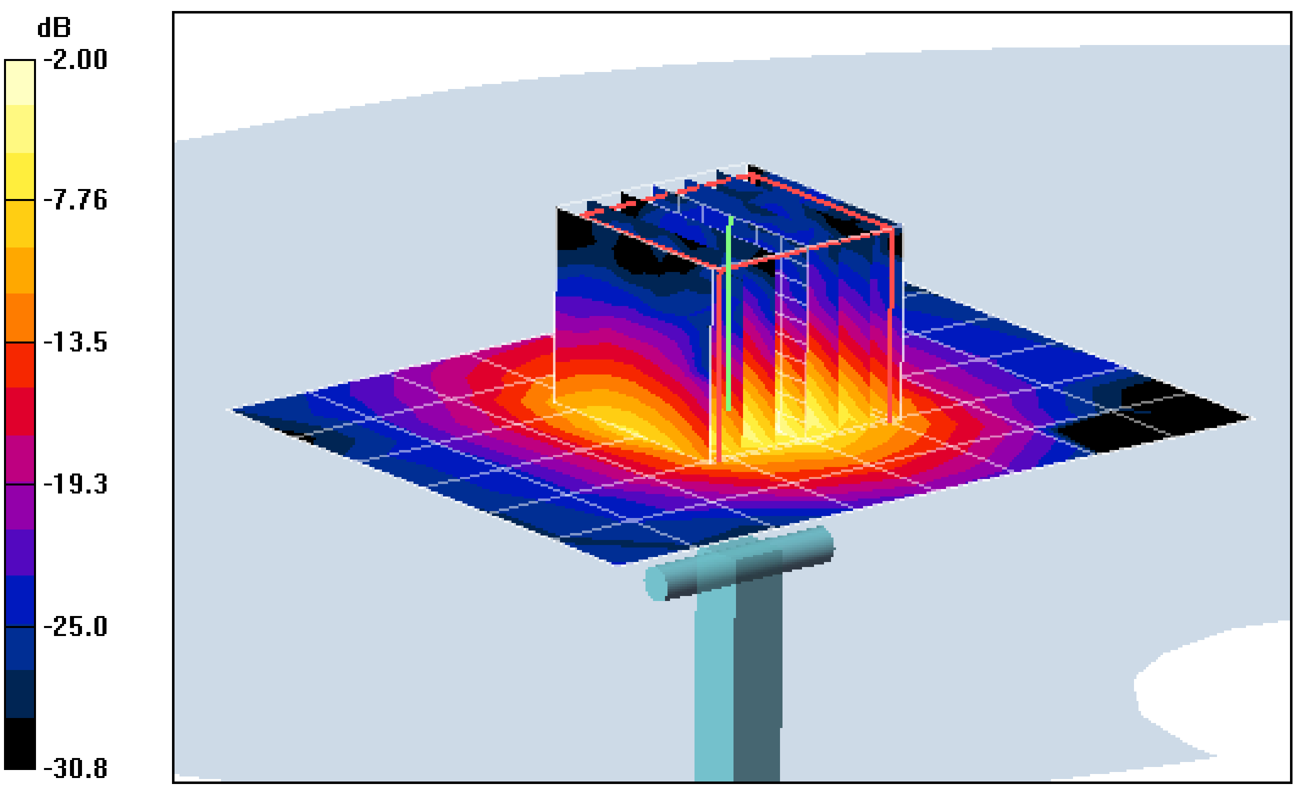
Communication System: CW; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body; Medium parameters used (interpolated):
f = 5200 MHz; σ = 5.44 mho/m; ε_r = 47.1; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-05-2011; Ambient Temp:24.3 °C; Tissue Temp: 22.7 °C

Probe: EX3DV4 - SN3550; ConvF(3.58, 3.58, 3.58); Calibrated: 2/14/2011
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

5200MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Input Power = 14.0 dBm (25 mW)
SAR(1 g) = 2 mW/g; SAR(10 g) = 0.555 mW/g
Deviation = 2.96 %



0 dB = 4.31mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5500 MHz; Type: D5GHzV2; Serial: 1057

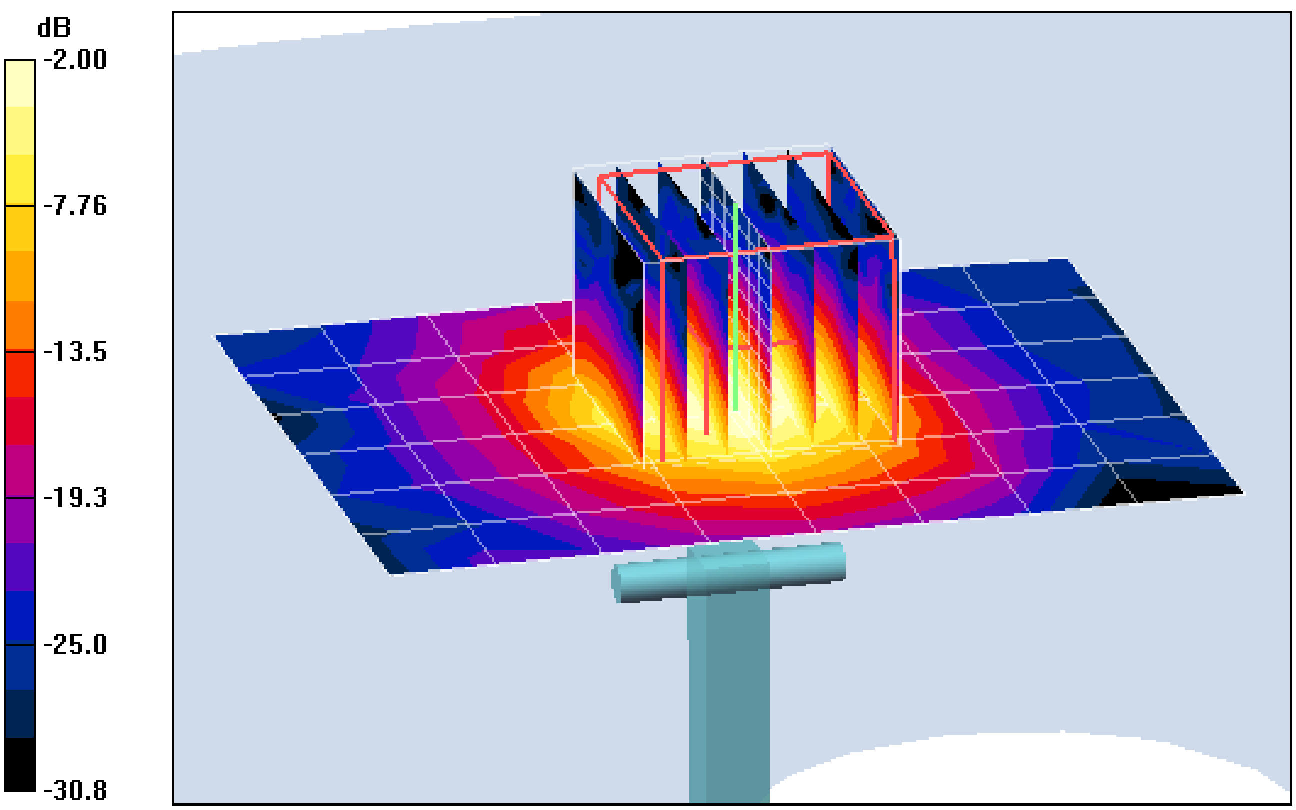
Communication System: CW; Frequency: 5500 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body; Medium parameters used (interpolated):
f = 5500 MHz; σ = 5.87 mho/m; ε_r = 46.6; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-05-2011; Ambient Temp:24.5 °C; Tissue Temp: 22.8 °C

Probe: EX3DV4 - SN3550; ConvF(3.21, 3.21, 3.21); Calibrated: 2/14/2011
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

5500MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan 2 (7x7x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Input Power = 14.0 dBm (25 mW)
SAR(1 g) = 2.03 mW/g; SAR(10 g) = 0.555 mW/g
Deviation = -3.79 %



0 dB = 4.39mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1057

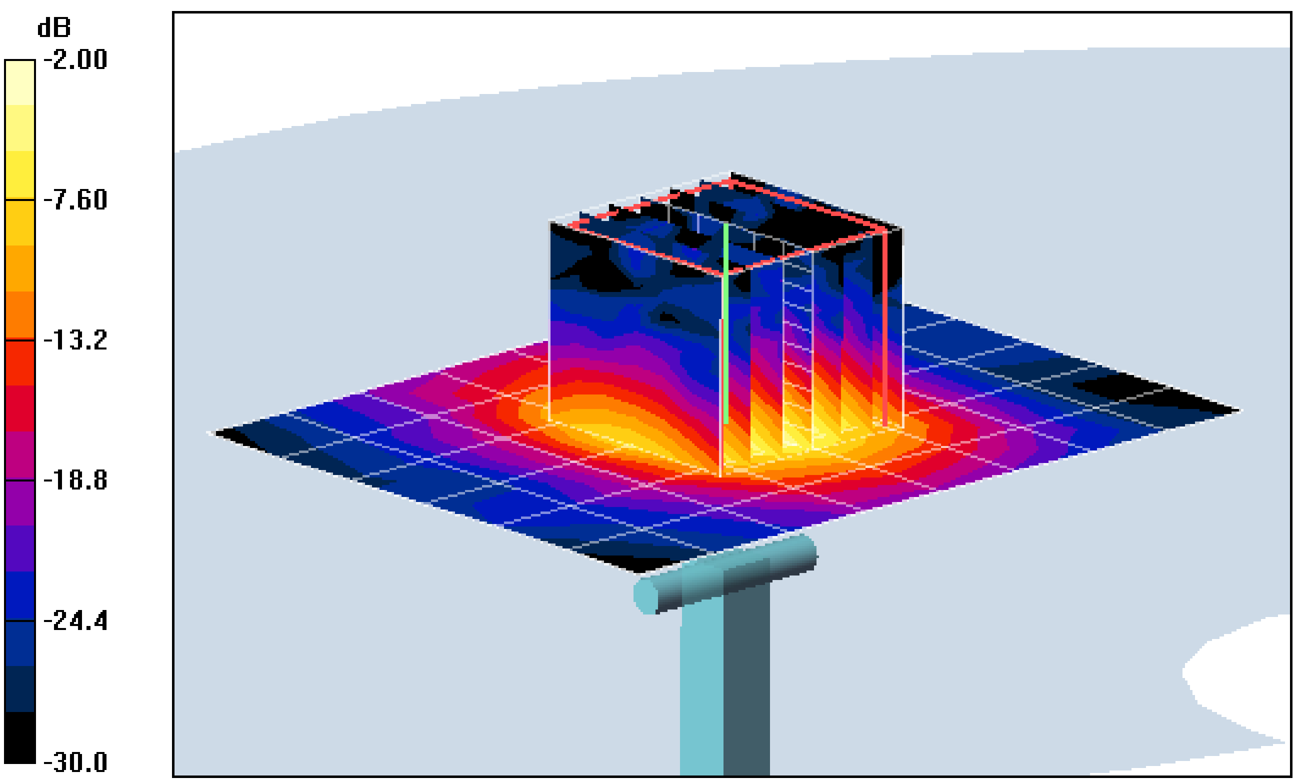
Communication System: CW; Frequency: 5800 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body; Medium parameters used (interpolated):
f = 5800 MHz; σ = 6.28 mho/m; ε_r = 46; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-05-2011; Ambient Temp:24.6 °C; Tissue Temp: 22.9 °C

Probe: EX3DV4 - SN3550; ConvF(3.29, 3.29, 3.29); Calibrated: 2/14/2011
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 7/8/2010
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

5800MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x11)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Input Power = 14.0 dBm (25 mW)
SAR(1 g) = 1.93 mW/g; SAR(10 g) = 0.527 mW/g
Deviation = 2.93 %



0 dB = 4.14mW/g

APPENDIX C: PROBE CALIBRATION

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **PC Test**

Certificate No: **ES3-3022_Sep10**

CALIBRATION CERTIFICATE

Object	ES3DV2 - SN:3022
Calibration procedure(s)	QA CAL-01.v6, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	September 21, 2010

KOK 9/29/10

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	20-Apr-10 (No. DAE4-660_Apr10)	Apr-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 22, 2010

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z: A, B, C* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ES3DV2

SN:3022

Manufactured:	April 15, 2003
Last calibrated:	September 18, 2009
Recalibrated:	September 21, 2010

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ES3DV2 SN:3022

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.01	1.05	1.01	± 10.1%
DCP (mV)[B]	92.8	92.5	89.7	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300.0	± 1.5%
			Y	0.00	0.00	1.00	300.0	
			Z	0.00	0.00	1.00	300.0	

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).

[B] Numerical linearization parameter: uncertainty not required.

[E] Uncertainty is determined using the maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV2 SN:3022

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
750	± 50 / ± 100	41.9 ± 5%	0.89 ± 5%	6.32	6.32	6.32	0.87	1.01 ± 11.0%
835	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	6.02	6.02	6.02	0.62	1.20 ± 11.0%
1750	± 50 / ± 100	40.1 ± 5%	1.37 ± 5%	5.01	5.01	5.01	0.27	2.23 ± 11.0%
1900	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	4.83	4.83	4.83	0.25	2.29 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	4.21	4.21	4.21	0.25	2.62 ± 11.0%
2600	± 50 / ± 100	39.0 ± 5%	1.96 ± 5%	4.14	4.14	4.14	0.25	2.64 ± 11.0%

[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

DASY/EASY - Parameters of Probe: ES3DV2 SN:3022

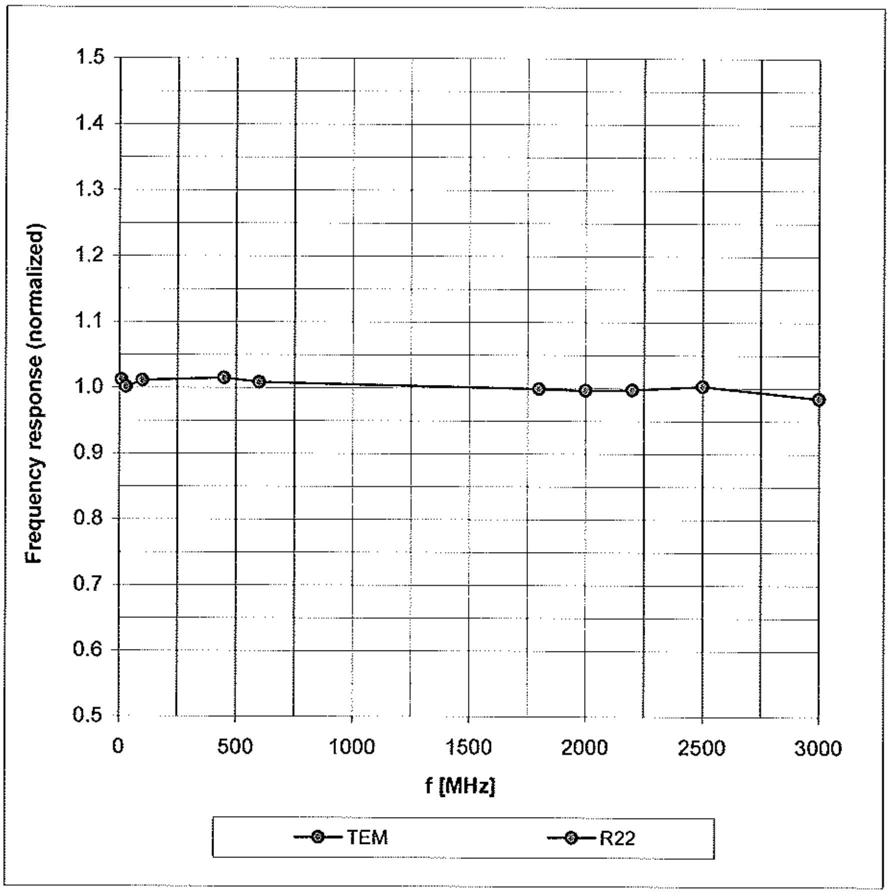
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
750	± 50 / ± 100	55.5 ± 5%	0.96 ± 5%	6.09	6.09	6.09	0.68	1.20 ± 11.0%
835	± 50 / ± 100	55.2 ± 5%	0.97 ± 5%	5.89	5.89	5.89	0.65	1.20 ± 11.0%
1750	± 50 / ± 100	53.4 ± 5%	1.49 ± 5%	4.59	4.59	4.59	0.23	2.83 ± 11.0%
1900	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.34	4.34	4.34	0.22	3.71 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	4.06	4.06	4.06	0.41	1.42 ± 11.0%
2600	± 50 / ± 100	52.5 ± 5%	2.16 ± 5%	4.06	4.06	4.06	0.53	1.23 ± 11.0%

[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

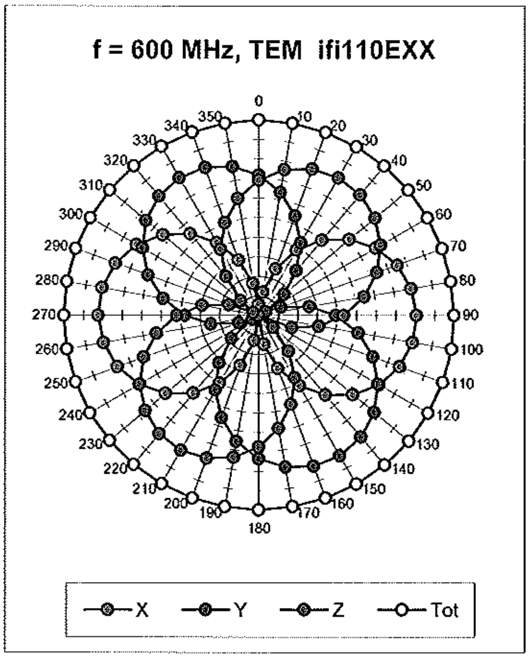
Frequency Response of E-Field

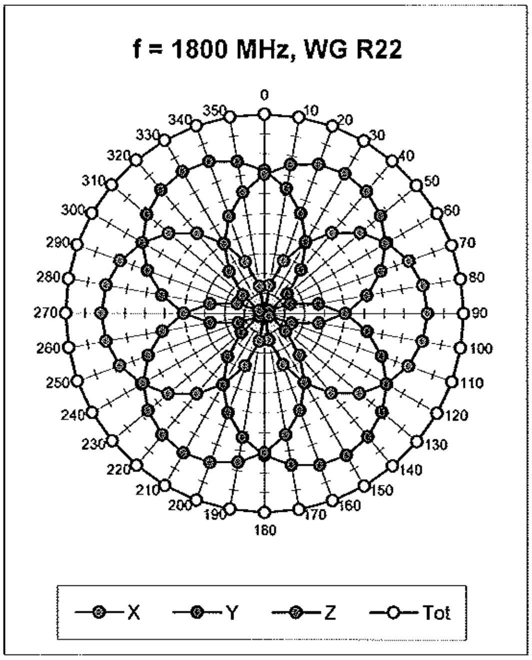
(TEM-Cell:ifi110 EXX, Waveguide: R22)

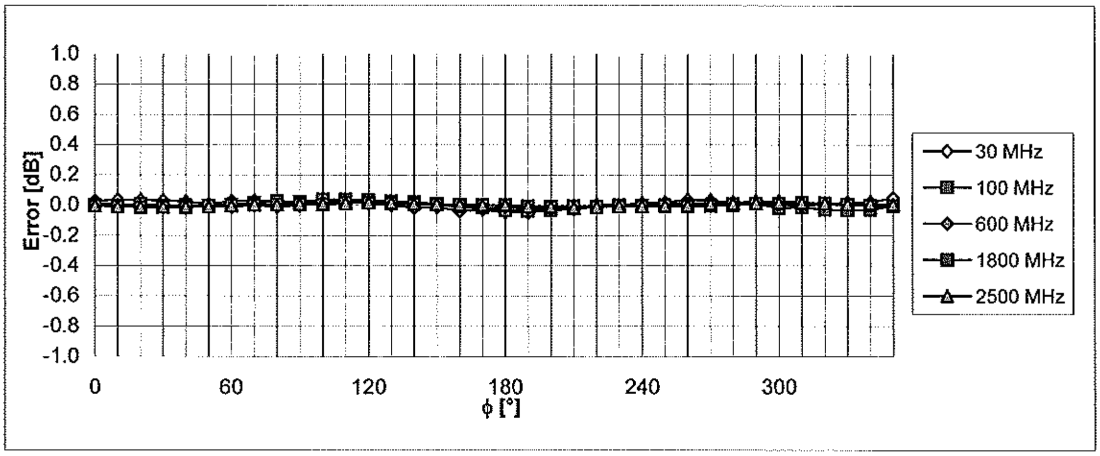


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



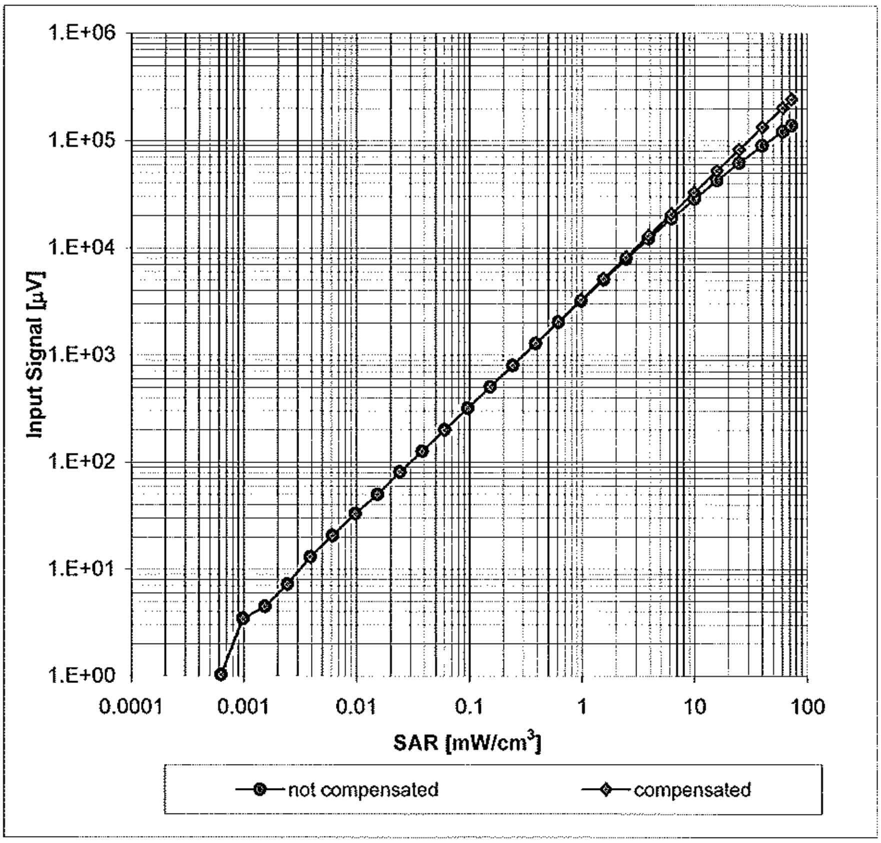


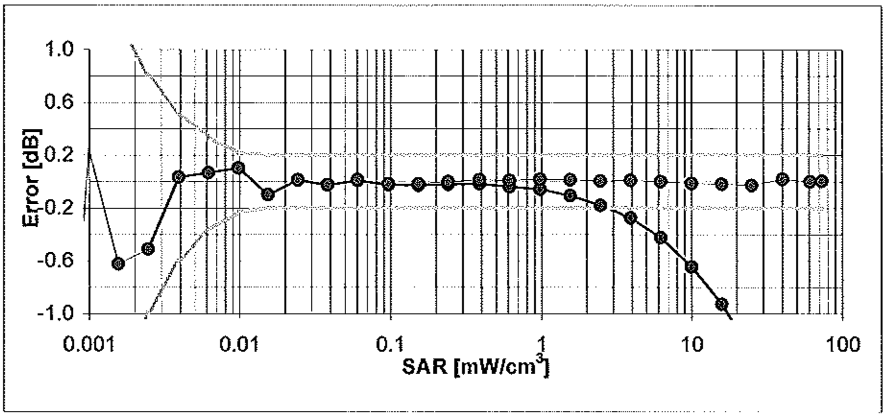


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

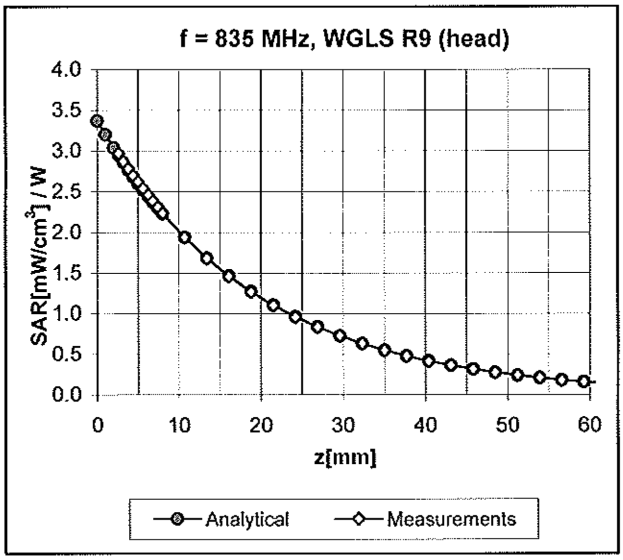
(Waveguide R22, f = 1800 MHz)

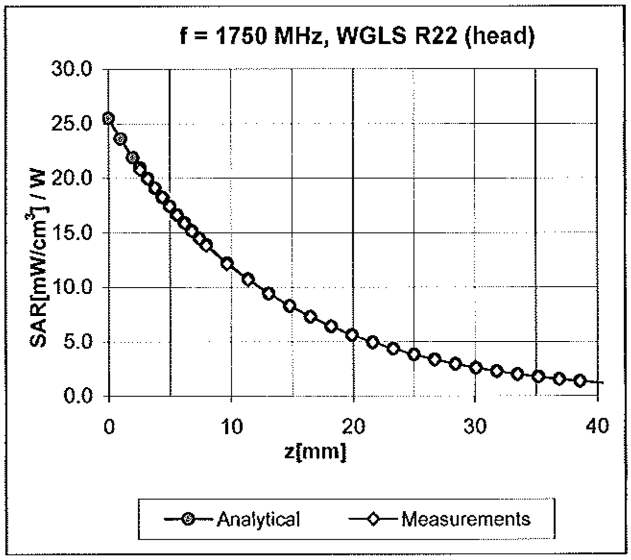




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

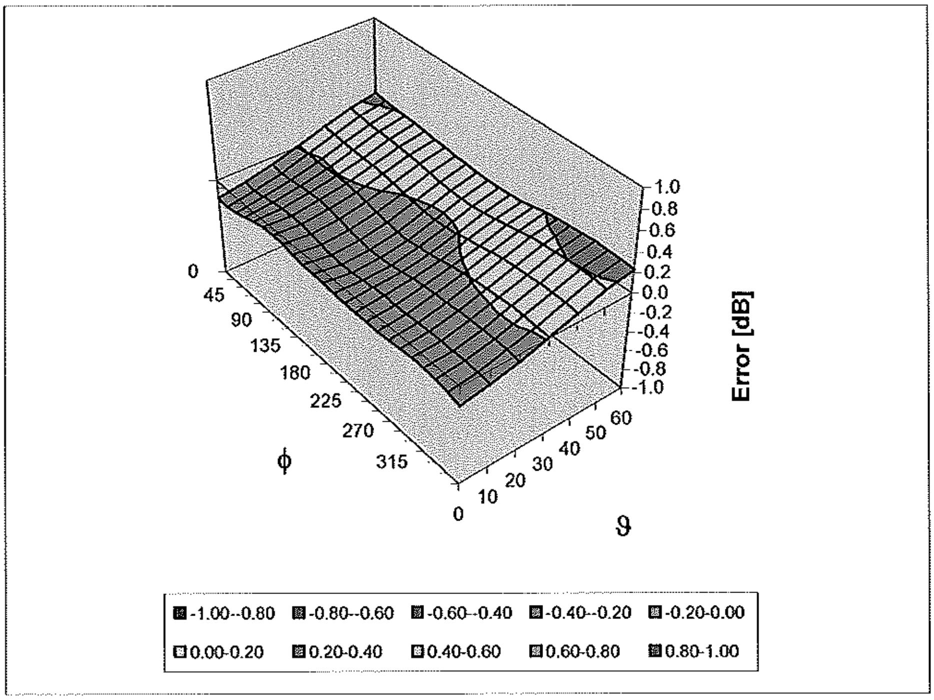
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4.0 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **EX-3550_Feb11**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3550
Calibration procedure(s)	QA CAL-01.v7, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v3 Calibration procedure for dosimetric E-field probes
Calibration date:	February 14, 2011

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

KOK 2/22/11

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	01-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	01-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	01-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 654	23-Apr-10 (No. DAE4-654_Apr10)	Apr-11
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: February 14, 2011

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization θ	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., θ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization θ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z* are numerical linearization parameters in dB assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media.
- *VR:* VR is the validity range of the calibration related to the average diode voltage or DAE voltage in mV.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe EX3DV4

SN:3550

Manufactured: May 19, 2004
Calibrated: February 14, 2011

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3550

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.52	0.45	0.50	± 10.1 %
DCP (mV)[B]	100.3	98.8	99.0	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	110.7	±2.2 %
			Y	0.00	0.00	1.00	145.7	
			Z	0.00	0.00	1.00	148.8	

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3550

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	8.42	8.42	8.42	0.48	0.69	± 12.0 %
835	41.5	0.90	8.04	8.04	8.04	0.33	0.84	± 12.0 %
1750	40.1	1.37	7.33	7.33	7.33	0.46	0.65	± 12.0 %
1900	40.0	1.40	7.01	7.01	7.01	0.42	0.72	± 12.0 %
2450	39.2	1.80	6.29	6.29	6.29	0.13	1.57	± 12.0 %
2600	39.0	1.96	6.13	6.13	6.13	0.20	1.32	± 12.0 %
4950	36.3	4.40	4.37	4.37	4.37	0.35	1.80	± 13.1 %
5200	36.0	4.66	4.06	4.06	4.06	0.35	1.80	± 13.1 %
5300	35.9	4.76	3.92	3.92	3.92	0.35	1.80	± 13.1 %
5500	35.6	4.96	3.77	3.77	3.77	0.35	1.80	± 13.1 %
5600	35.5	5.07	3.50	3.50	3.50	0.40	1.80	± 13.1 %
5800	35.3	5.27	3.64	3.64	3.64	0.40	1.80	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: EX3DV4- SN:3550

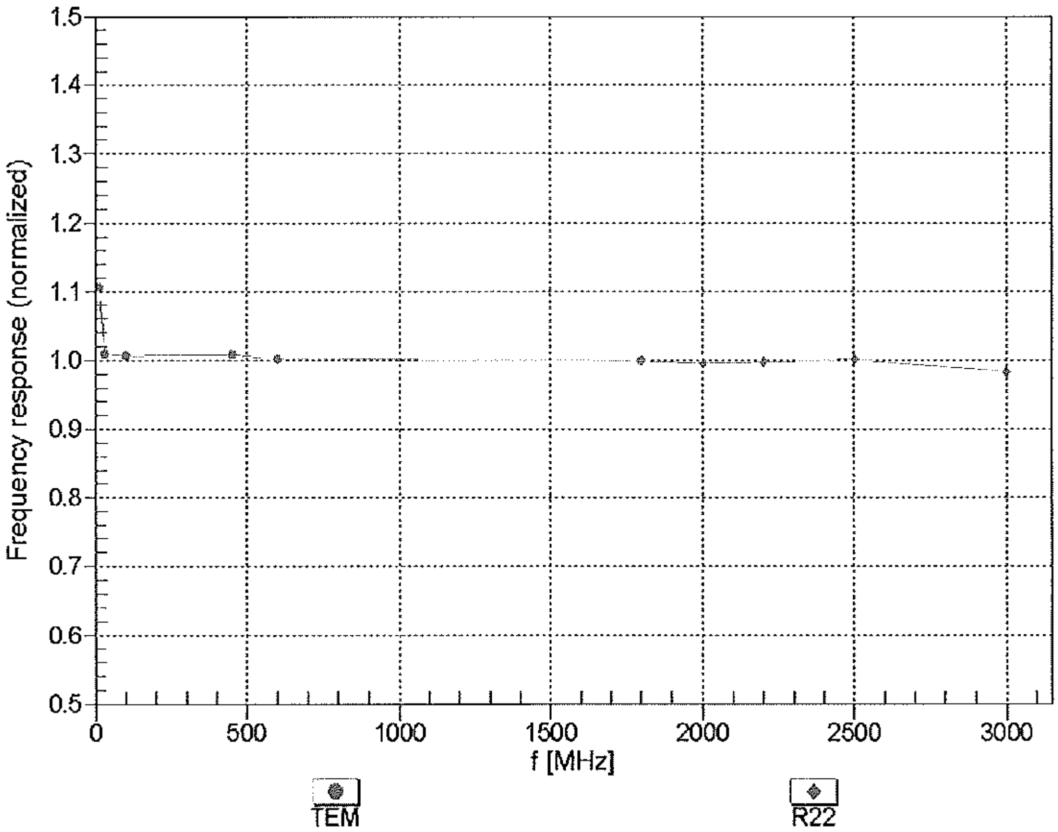
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	8.18	8.18	8.18	0.23	1.09	± 12.0 %
835	55.2	0.97	8.11	8.11	8.11	0.25	1.05	± 12.0 %
1750	53.4	1.49	7.21	7.21	7.21	0.42	0.89	± 12.0 %
1900	53.3	1.52	6.77	6.77	6.77	0.35	0.84	± 12.0 %
2450	52.7	1.95	6.25	6.25	6.25	0.30	0.86	± 12.0 %
2600	52.5	2.16	5.98	5.98	5.98	0.21	1.03	± 12.0 %
3700	51.0	3.55	5.42	5.42	5.42	0.20	1.95	± 13.1 %
4950	49.4	5.01	3.72	3.72	3.72	0.45	1.90	± 13.1 %
5200	49.0	5.30	3.58	3.58	3.58	0.45	1.90	± 13.1 %
5300	48.9	5.42	3.31	3.31	3.31	0.48	1.90	± 13.1 %
5500	48.6	5.65	3.21	3.21	3.21	0.47	1.90	± 13.1 %
5600	48.5	5.77	3.19	3.19	3.19	0.45	1.90	± 13.1 %
5800	48.2	6.00	3.29	3.29	3.29	0.50	1.90	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

Frequency Response of E-Field

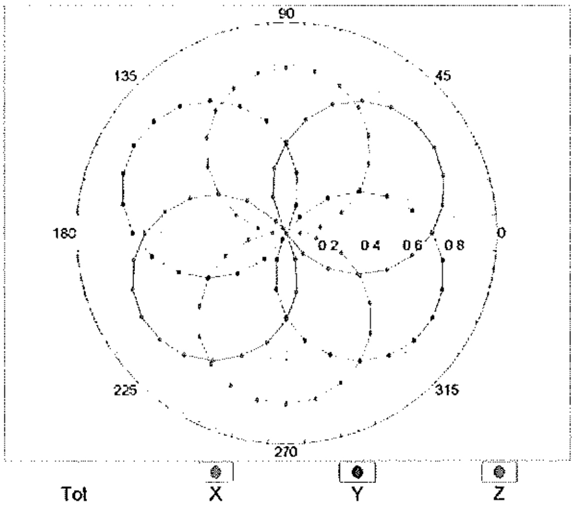
(TEM-Cell:ifi110 EXX, Waveguide: R22)



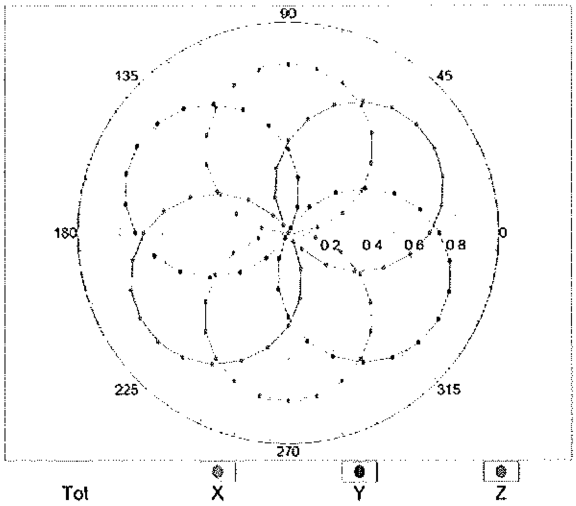
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

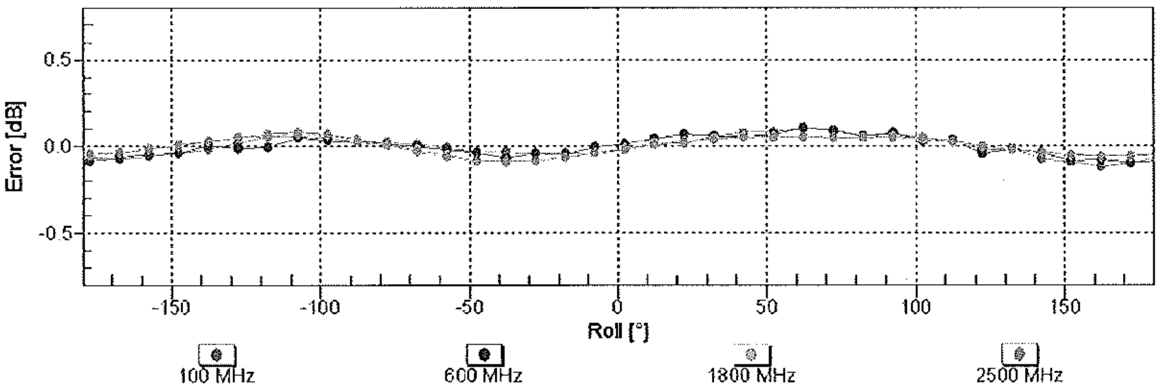
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



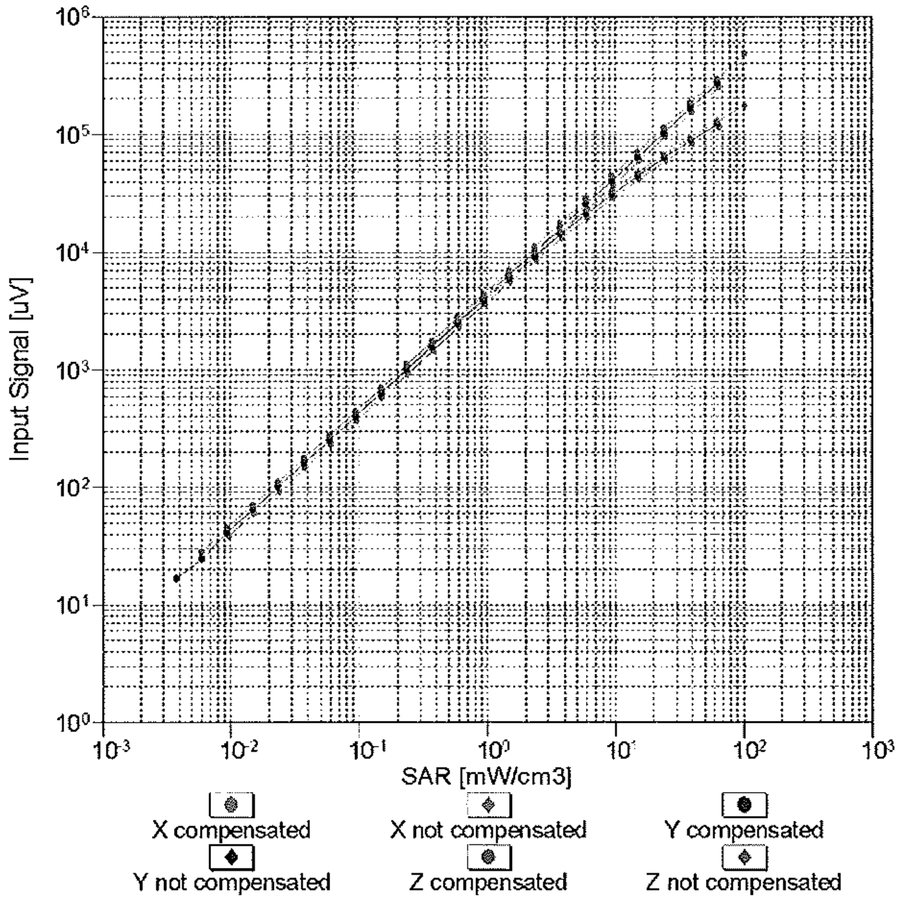
f=1800 MHz,R22

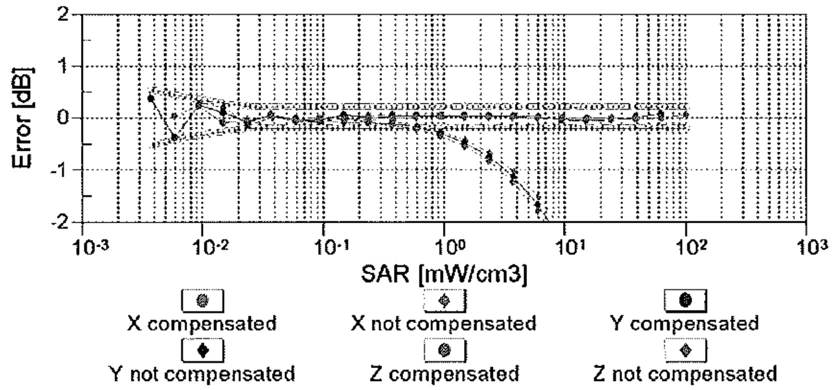




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

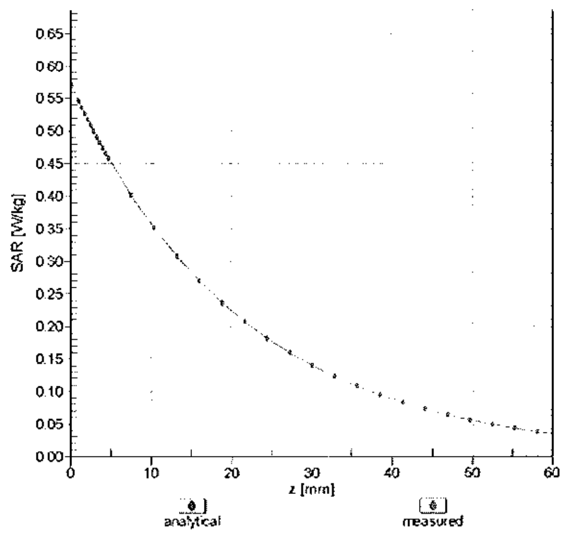
Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)

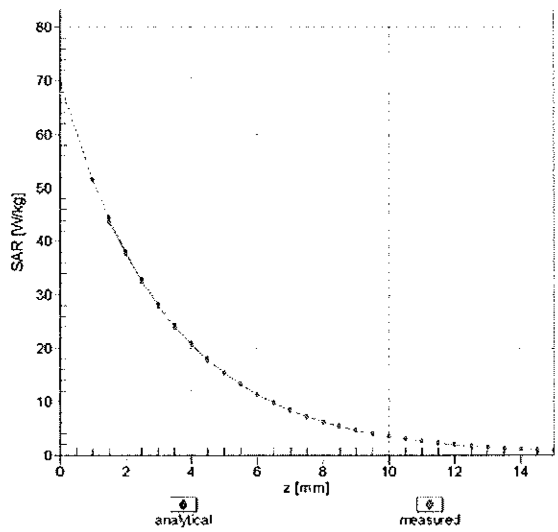




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

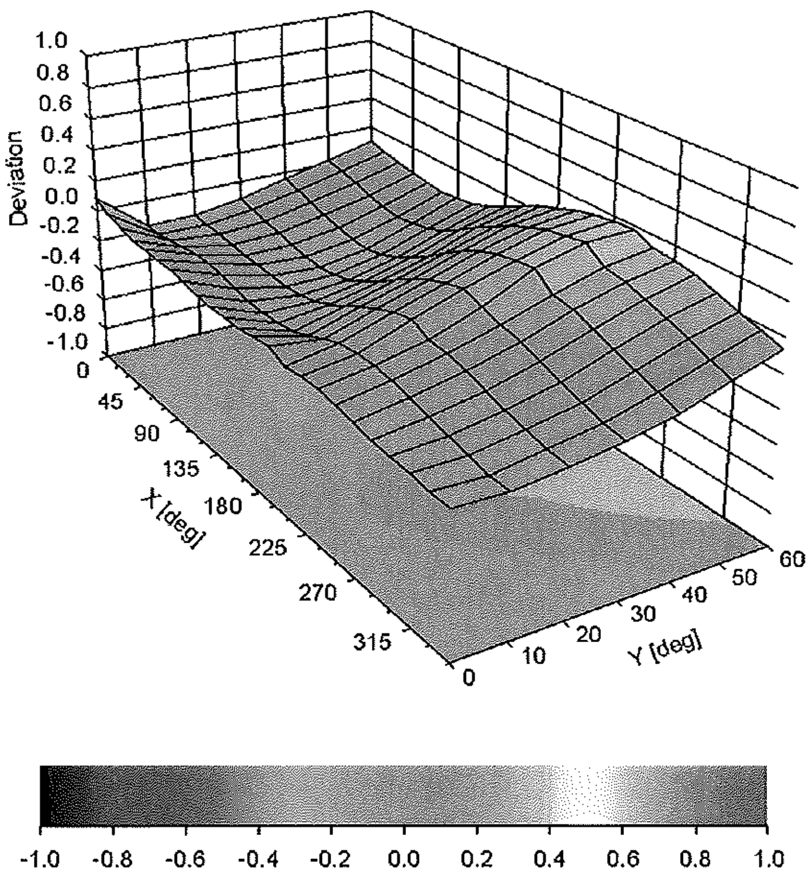
Conversion Factor Assessment





Deviation from Isotropy in Air

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3550

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	3 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **PC Test**

Certificate No: EX3-3561_Aug10

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3561
Calibration procedure(s)	QA CAL-01.v6, QA CAL-14.v3, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	August 19, 2010

KOK 8/30/10

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	20-Apr-10 (No. DAE4-660_Apr10)	Apr-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: August 20, 2010

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z: A, B, C* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe EX3DV4

SN:3561

Manufactured:	February 14, 2005
Last calibrated:	August 26, 2008
Recalibrated:	August 19, 2010

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 SN:3561

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.45	0.48	0.43	± 10.1%
DCP (mV)[B]	87.4	89.6	88.5	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300	± 1.5%
			Y	0.00	0.00	1.00	300	
			Z	0.00	0.00	1.00	300	

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6).

[B] Numerical linearization parameter: uncertainty not required.

[E] Uncertainty is determined using the maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value

DASY/EASY - Parameters of Probe: EX3DV4 SN:3561

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][c]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth	Unc (k=2)
750	± 50 / ± 100	41.9 ± 5%	0.89 ± 5%	8.36	8.36	8.36	0.76	0.64	± 11.0%
835	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	7.96	7.96	7.96	0.75	0.64	± 11.0%
1750	± 50 / ± 100	40.1 ± 5%	1.37 ± 5%	6.92	6.92	6.92	0.90	0.57	± 11.0%
1900	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	6.69	6.69	6.69	0.76	0.63	± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	6.11	6.11	6.11	0.42	0.83	± 11.0%
2600	± 50 / ± 100	39.0 ± 5%	1.96 ± 5%	6.09	6.09	6.09	0.36	0.93	± 11.0%

[c] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

DASY/EASY - Parameters of Probe: EX3DV4 SN:3561

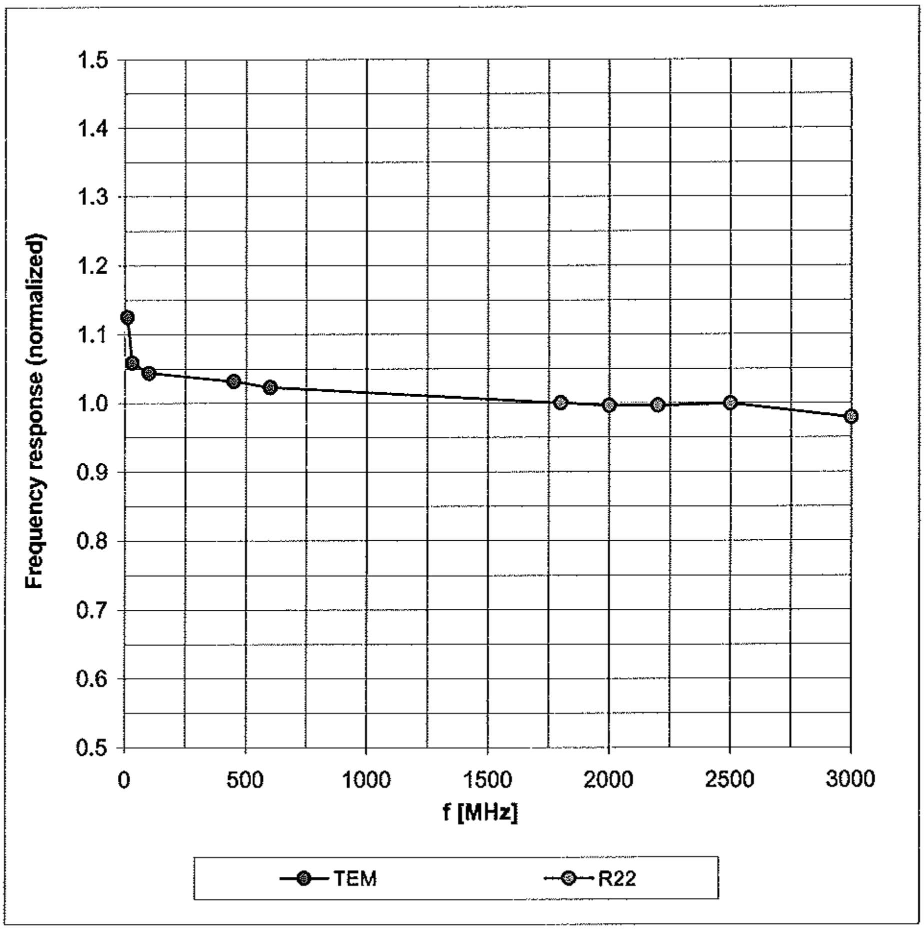
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
835	± 50 / ± 100	55.2 ± 5%	0.97 ± 5%	8.09	8.09	8.09	0.74	0.65 ± 11.0%
1750	± 50 / ± 100	53.4 ± 5%	1.49 ± 5%	6.84	6.84	6.84	0.43	0.82 ± 11.0%
1900	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	6.59	6.59	6.59	0.56	0.71 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	6.44	6.44	6.44	0.37	0.87 ± 11.0%
2600	± 50 / ± 100	52.5 ± 5%	2.16 ± 5%	6.45	6.45	6.45	0.37	0.95 ± 11.0%
4950	± 50 / ± 100	49.4 ± 5%	5.01 ± 5%	3.80	3.80	3.80	0.53	1.90 ± 13.1%
5200	± 50 / ± 100	49.0 ± 5%	5.30 ± 5%	3.67	3.67	3.67	0.60	1.95 ± 13.1%
5300	± 50 / ± 100	48.5 ± 5%	5.42 ± 5%	3.42	3.42	3.42	0.63	1.95 ± 13.1%
5500	± 50 / ± 100	48.6 ± 5%	5.65 ± 5%	3.31	3.31	3.31	0.63	1.95 ± 13.1%
5600	± 50 / ± 100	48.5 ± 5%	5.77 ± 5%	3.12	3.12	3.12	0.65	1.95 ± 13.1%
5800	± 50 / ± 100	48.2 ± 5%	6.00 ± 5%	3.25	3.25	3.25	0.65	1.95 ± 13.1%

[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

Frequency Response of E-Field

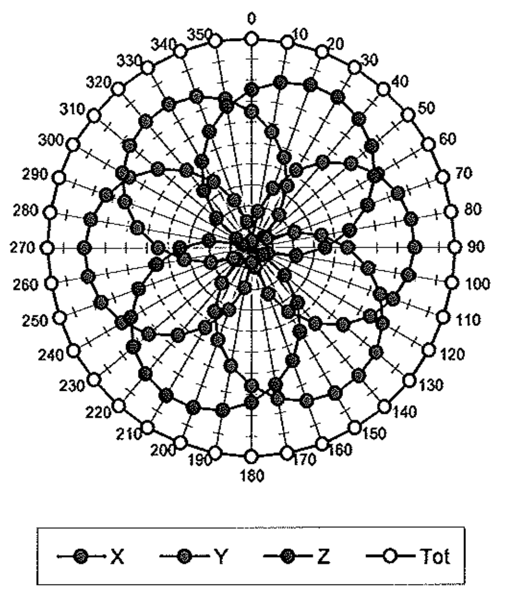
(TEM-Cell:ifi110 EXX, Waveguide: R22)



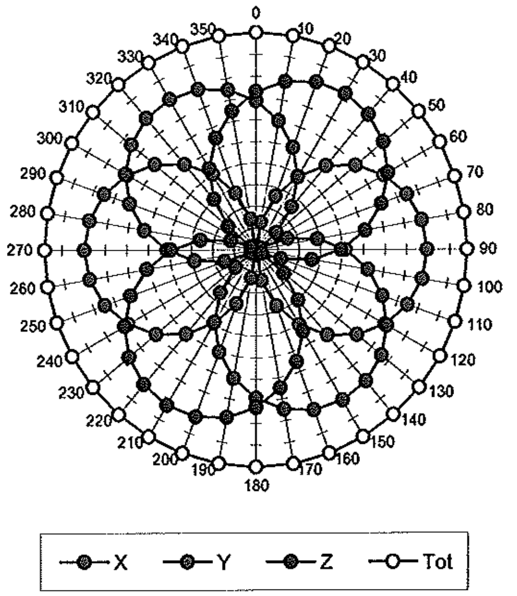
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

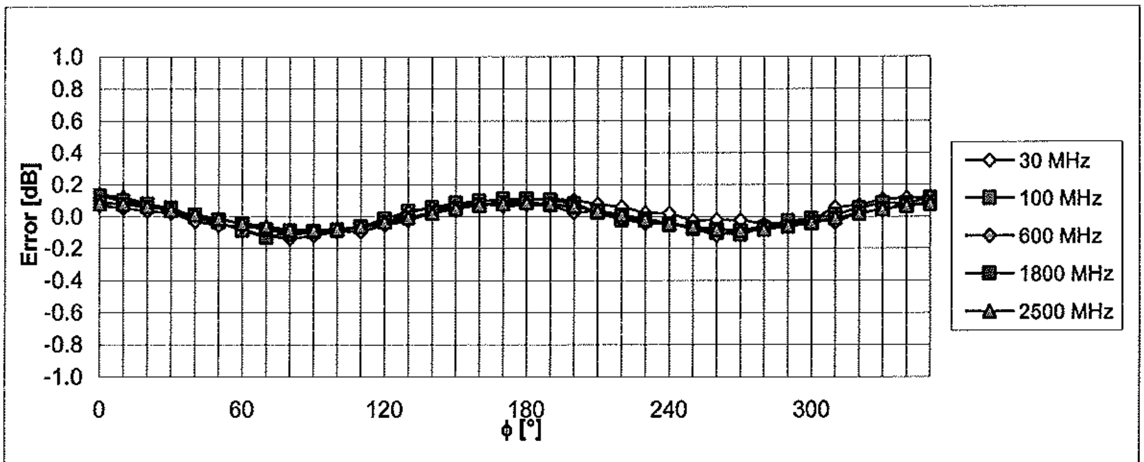
Receiving Pattern (ϕ), ϑ = 0°

f = 600 MHz, TEM ifi110EXX



f = 1800 MHz, WG R22

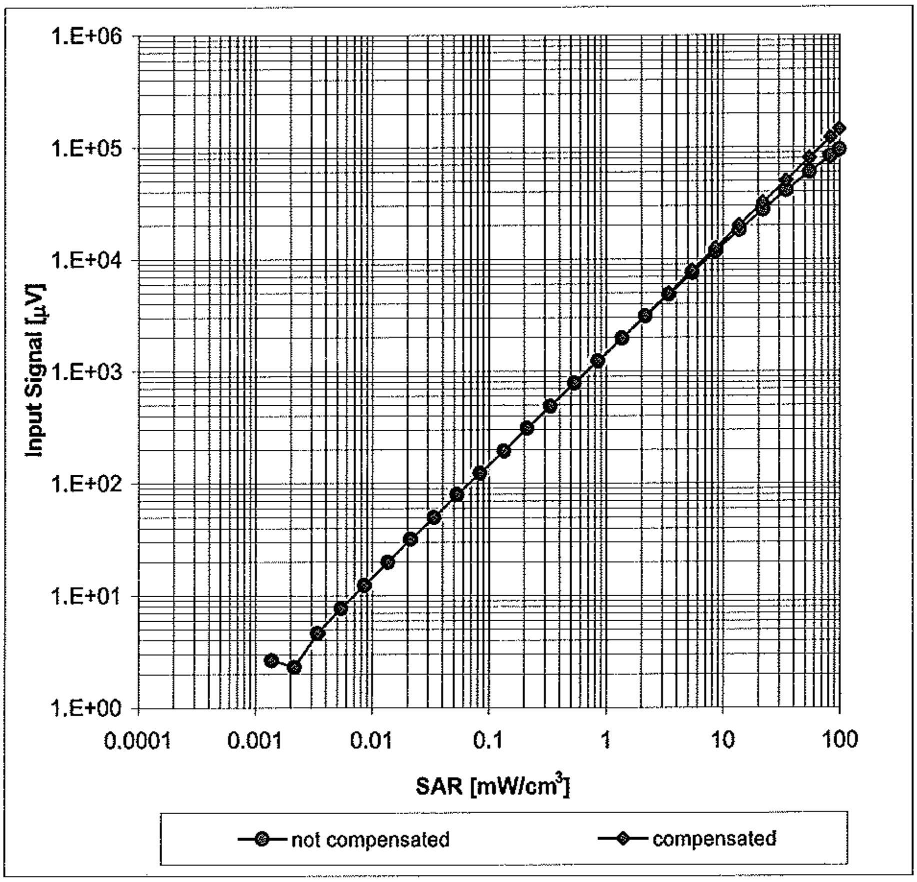


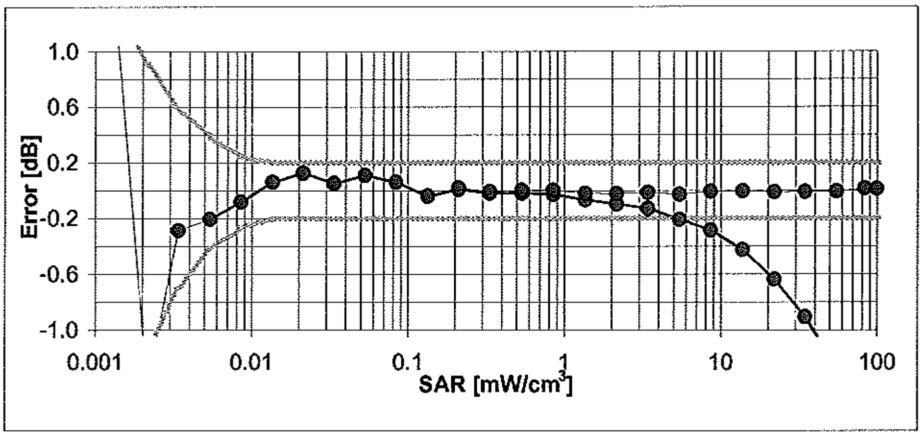


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

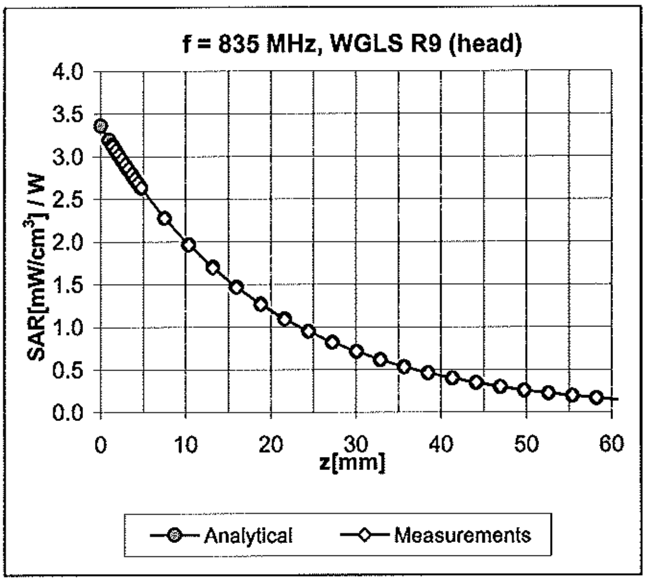
(Waveguide R22, f = 1800 MHz)

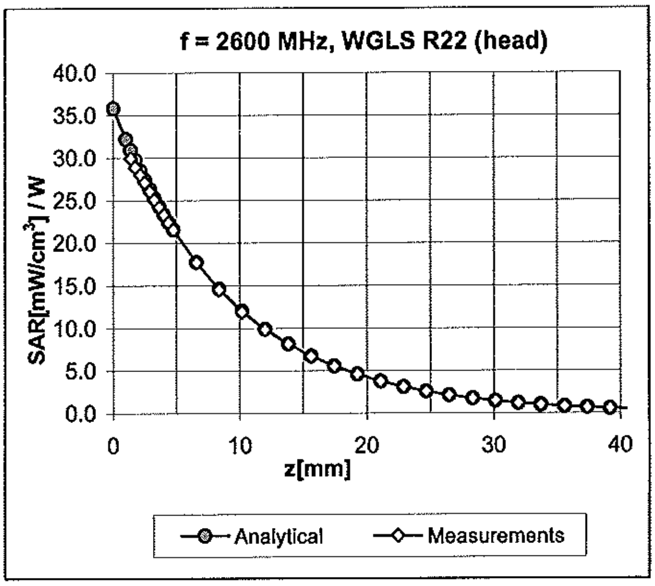




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

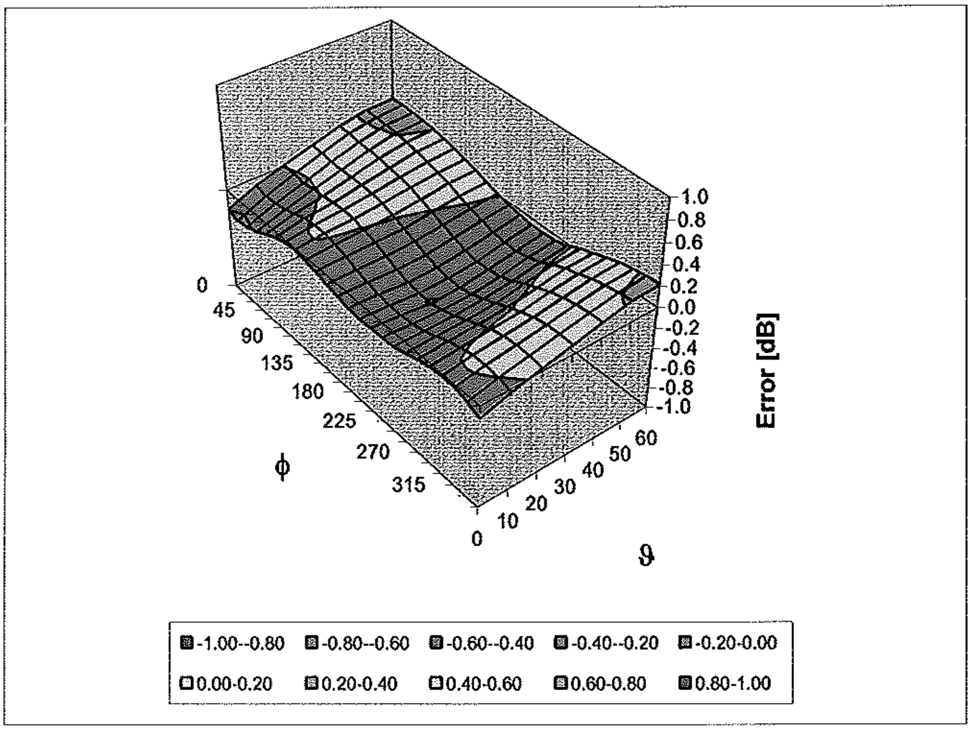
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client PC Test

Certificate No: D750V3-1003_Feb11

CALIBRATION CERTIFICATE

Object	D750V3 - SN: 1003
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits
Calibration date:	February 14, 2011

✓ KOK 2/22/11

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	D. Iliev
Approved by:	Katja Pokovic	Technical Manager	[signature]

Issued: February 14, 2011

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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C Service suisse d'étalonnage
S Servizio svizzero di taratura
Swiss Calibration Service

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The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.3 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature during test	(20.5 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.13 mW / g
SAR normalized	normalized to 1W	8.52 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**8.37 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.39 mW / g
SAR normalized	normalized to 1W	5.56 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**5.49 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.8 ± 6 %	0.96 mho/m ± 6 %
Body TSL temperature during test	(21.0 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.21 mW / g
SAR normalized	normalized to 1W	8.84 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**8.85 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.46 mW / g
SAR normalized	normalized to 1W	5.84 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**5.84 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.7 Ω - 0.8 jΩ
Return Loss	- 26.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.8 Ω - 3.6 jΩ
Return Loss	- 28.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.045 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	January 21, 2009

DASY5 Validation Report for Head TSL

Date/Time: 14.02.2011 10:43:27

Test Laboratory: SPEAG, Zurich, Switzerland

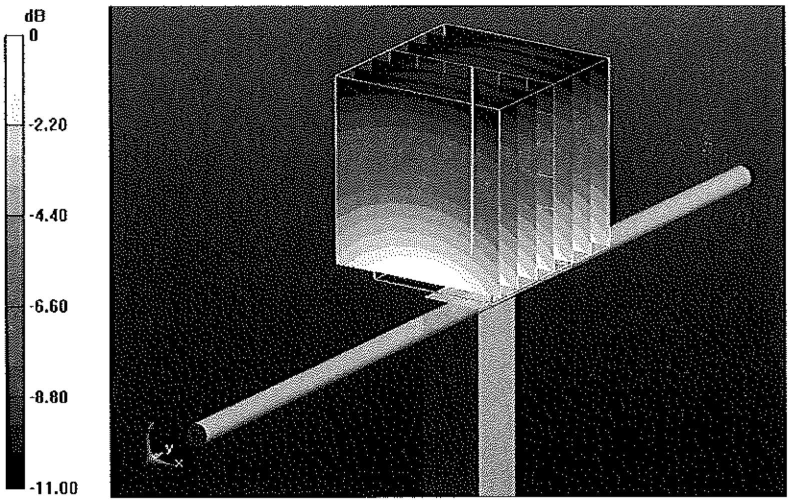
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1003

Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1
Medium: HSL750
Medium parameters used: f = 750 MHz; σ = 0.91 mho/m; ε_r = 41.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

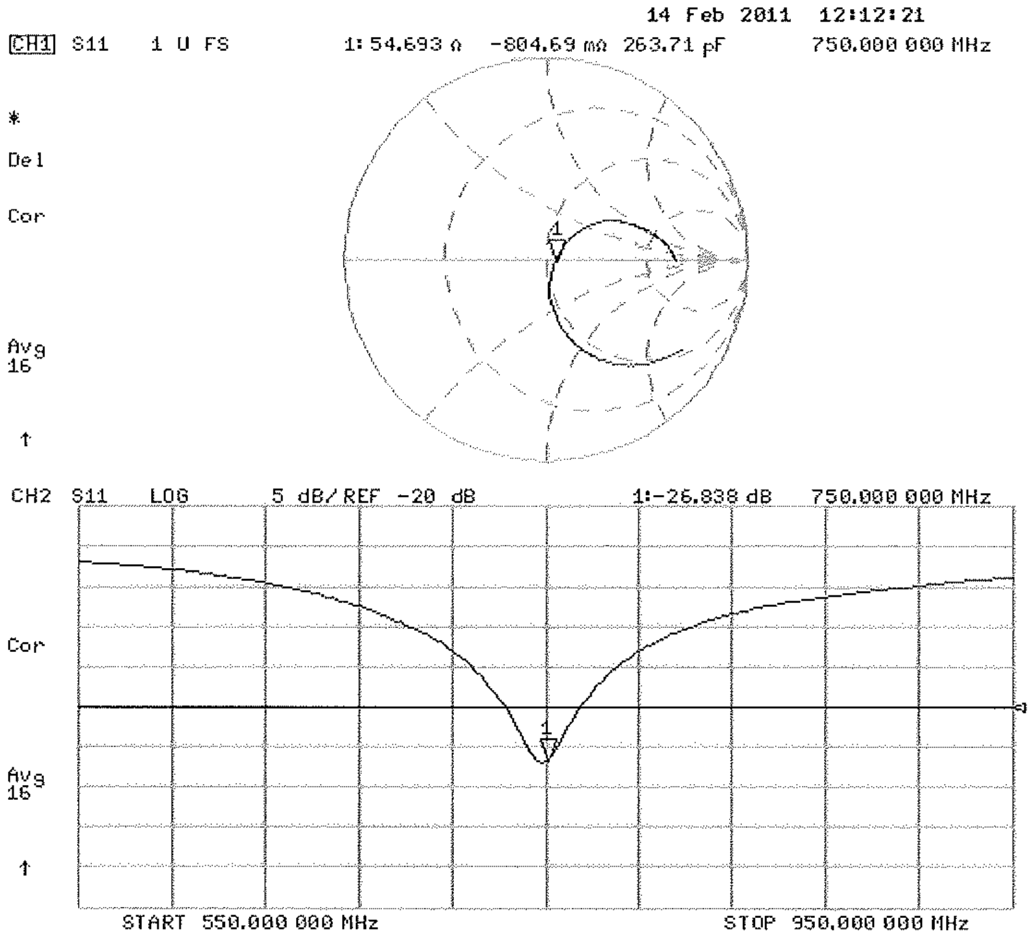
- Probe: ES3DV3 - SN3205; ConvF(6.37, 6.37, 6.37); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

Pin=250mW; dip=15mm; dist=3.0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.701 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.228 W/kg
SAR(1 g) = 2.13 mW/g; SAR(10 g) = 1.39 mW/g
Maximum value of SAR (measured) = 2.495 mW/g



0 dB = 2.500mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 14.02.2011 12:11:08

Test Laboratory: SPEAG, Zurich, Switzerland

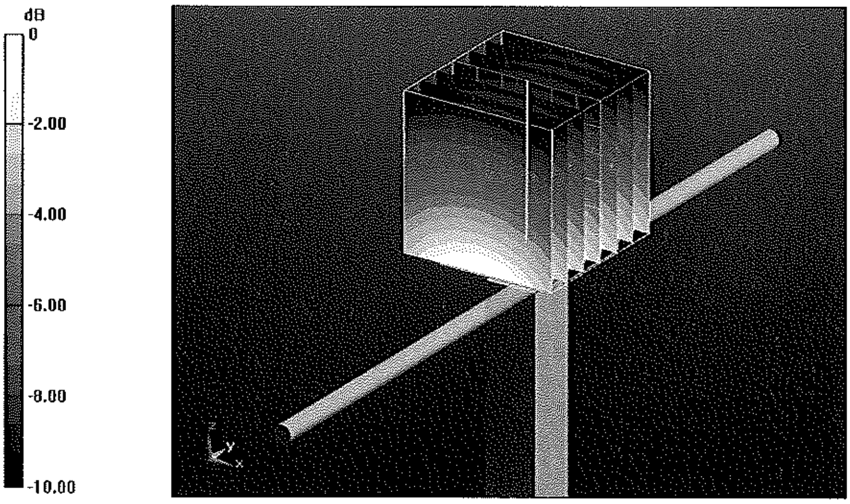
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1003

Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1
Medium: MSL750
Medium parameters used: f = 750 MHz; σ = 0.96 mho/m; ε_r = 55.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.08, 6.08, 6.08); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

Pin=250mW; dip=15mm; dist=3.0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.359 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.233 W/kg
SAR(1 g) = 2.21 mW/g; SAR(10 g) = 1.46 mW/g
Maximum value of SAR (measured) = 2.574 mW/g



0 dB = 2.570mW/g

Impedance Measurement Plot for Body TSL